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The Intertidal Fauna of Sandy Beaches–a Survey of the Scottish Coast

A Eleftheriou and
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The Intertidal Fauna of Sandy Beaches-a Survey of the Scottish Coast

A Eleftheriou and A D McIntyre

Marine Laboratory Aberdeen

Introduction

Most of the sandy bays round the Scottish coast are nursery grounds for flatfish, of which the plaice, *Pleuronectes platessa* (L.), is the most important species (Lamont, 1963). These fish, during their first year of benthic life, are found in very shallow water (Edwards and Steele, 1968) and at the times of high tide they move into the intertidal zone, which can therefore be an important feeding ground. Since the invertebrate biomass is very variable from one site to another, it was decided to examine a large number of bays to define the range of food available and to try to account for the observed variation. Further, since most of the beaches studied were unaffected by significant domestic or industrial effluent, it was hoped to obtain a statement of the range of natural variation of faunal indices which would be characteristic of boreal intertidal sand, and which would be useful for comparison with polluted areas. From experience gained from several years' study of one beach (McIntyre and Eleftheriou, 1968), the intention was to deal summarily with many beaches, usually visiting each one, and sampling only sufficiently to give a reliable picture of the main faunistic indices.

Methods

On each beach, observations were first made on such general aspects as overall beach structure, degree of exposure and presence and position of freshwater inflows. The sand surface was then surveyed for worm casts, burrows, shells, etc., and extensive digging was done to assess the larger fauna. Finally, on most beaches, a simple surveying technique was used to construct profiles levelled from a suitable bench mark, and a series of station positions were then selected for detailed sampling. Main stations were always placed at high tide, mid tide and low tide on the profile lines. Intermediate stations, the number of which depended on the varying width of the intertidal zones, were placed between the main stations. Lateral stations, depending on the length of the beach, were further inserted parallel to the tide line at selected beach levels. At each station at least one quadrat of 1/16 m^2 surface area was dug to a depth of 15 cm for macrofauna and the sand sieved through a ½ mm mesh. After identification and counting of the animals, the rough wet weight was measured after drying on blotting paper. Dry weights were then obtained by removing or dissolving in dilute HCl all calcareous structures and drying to constant weight at under 100° C. For the smaller species, conversion factors were calculated relating rough wet weight to dry weight. Cores for meiofauna were collected and some of these are described elsewhere (McIntyre, 1973; McIntyre and Murison, 1973). Samples were taken for particle size analyses in perspex tubes of 4.3 cm diameter, usually to a depth of 20 cm. Most cores were divided into sections 4 cm long, so that the vertical stratification could be determined, and the use of perspex tubes made it possible to observe any obvious layers within the core before sectioning. The soil samples were washed free of salt, dried at 100° C and analysed after passing through a series of sieves as described in McIntyre and Murison (1973). From the results, cumulative curves were drawn and median diameters and sorting co-efficients calculated. In addition, observations were made on drainage, salinity and temperature of the interstitial water.

Care was taken to conduct the surveys during good spring tides, which would expose the beaches at similar levels, making valid comparison easier.

On some beaches, natural differences in the substratum (rock intrusions, boulders) or structures such as sea walls or roads, affected or eliminated certain levels. The sampling area was thus sometimes restricted and all faunistic comparisons were related to similar levels of other beaches.

The surveys were spread over several years (1966-1970) and were primarily conducted during the period March-October. This part of the year is characterised by more stable environmental conditions, and represents the more active period of organisms as well as maximum density and biomass. Differences in the timing of sampling could be responsible for variations in the faunal composition and more probably in the density and biomass between beaches. It is also possible that some populations could be undergoing slow or long-term changes, as in the *Tellina* population of Firemore Bay (McIntyre, 1970). Although these changes may require several years before they become noticeable, and probably do not seriously affect the present study, we should be aware of such difficulties involved in the interpretation of data and quantitative and qualitative comparisons of long-term general studies. For comparative purposes the beaches were considered in three groups, exposed, semi-exposed and sheltered, using empirical criteria based on common physical features such as location of beach in relation to prevailing winds, fetch, beach relief, sediment characteristics etc., and biological characteristics such as number of species present, density of animals and biomass.

The Habitat

The 21 beaches, which are all on the north and west coasts of Scotland (Fig. 1) are listed below:

North Coast	1. Dunnet
	2. Sandside
	3. Strathy
Outer Hebrides	4. North Uist: Traigh Iar
	5. Barra: Traigh Eais
	6. Barra: Traigh Mhor
West Coast	7. Gruinard
	8. Loch Ewe: Mellon Charles
	9. Loch Ewe: Aultbea
	10. Loch Ewe: Inverasdale
	11. Loch Ewe: Firemore Bay, South
	12. Loch Ewe: Firemore Bay, North
	13. Gairloch: head beach
	14. Gairloch: Big Sand
South West Coast	15. Loch Gilp
	16. Clyde: Barassie
	17. Clyde: Prestwick
	18. Clyde: Turnberry
	19. Clyde: Lendalfoot
	20. Clyde: Port Logan
	21. Luce Bay: Sandhead

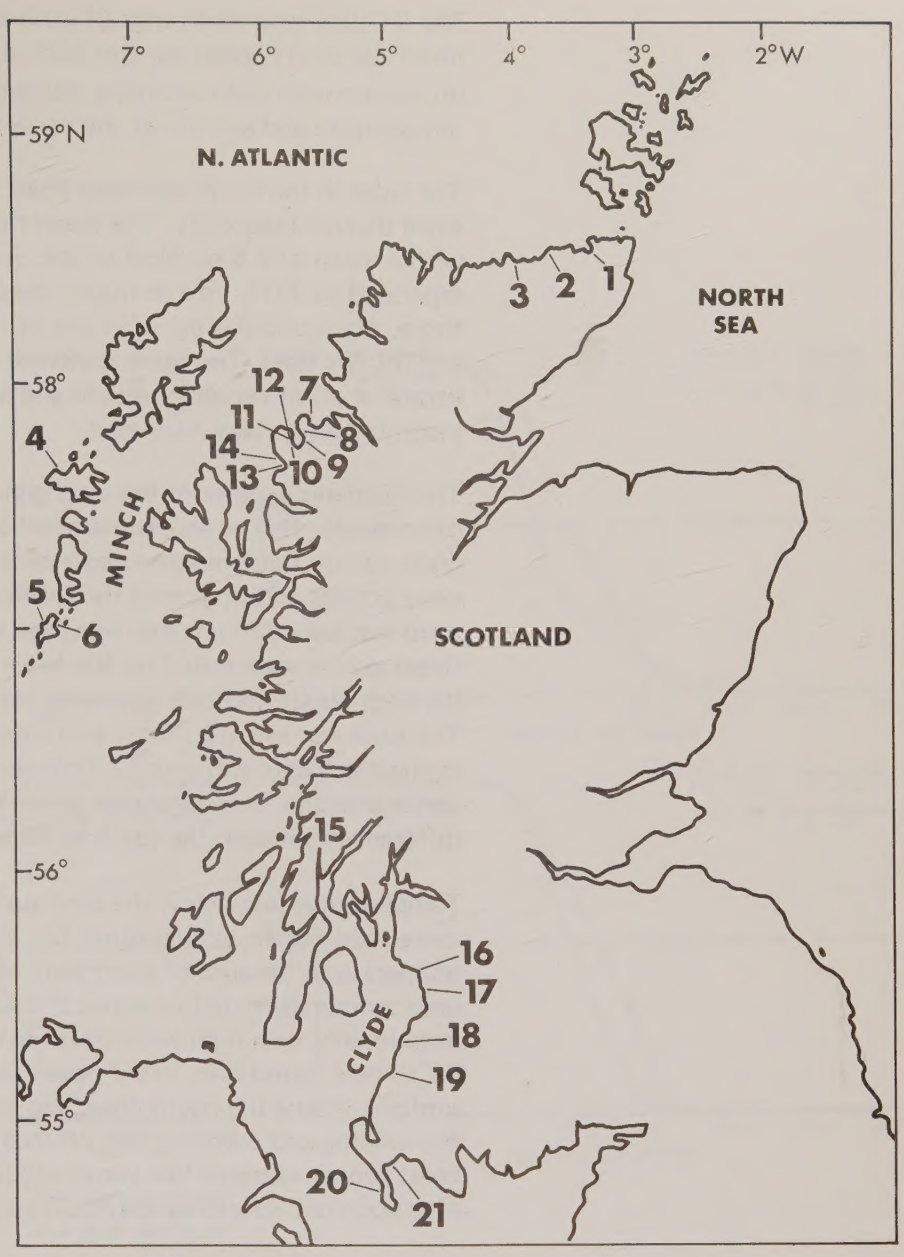

Figure 1. Map showing location of sampled beaches.

1. Dunnet; 2. Sandside; 3. Strathy; 4. Traigh Iar; 5. Traigh Eais; 6. Traigh Mhor; 7. Gruinard; 8. Mellon Charles; 9. Aultbea; 10. Inverasdale; 11. Firemore Bay, South; 12. Firemore Bay, North; 13. Gairloch; 14. Big Sand; 15. Loch Gilp; 16. Barassie; 17. Prestwick; 18. Turnberry; 19. Lendalfoot; 20. Port Logan; 21. Sandhead.

The area involved is large and geologically variable, characterised by different geomorphological complexes. The north of Scotland has little protection from gales and heavy seas. Even in calm weather, swell is a constant feature of the sea in this area. Cliffs and rocky shores are typical of the coastal scenery, but a few pocket beaches, shallow and exposed, are present and three of these (numbers 1-3) were examined. Similarly exposed conditions are found along the extreme western seaboard of Scotland on the Outer Hebrides, where sand is present either in long intertidal stretches, or as small areas between rocks. Beaches 4 and 5 represent these conditions of exposure to severe wave action and Atlantic swell. On the west coast of the mainland, and on island beaches facing away from the Atlantic, exposure is less severe and beaches 6 to 15 illustrate the range found in this area, with the most sheltered (6, 9, 15) found inside sea lochs and protected by land masses, and the more exposed open to wind and waves from outside the lochs (8, 11, 14). Finally the beaches examined on the south-west coast are in general more sheltered than those farther north. The eastern side of the Firth of Clyde and Luce Bay are characterised by extensive sandy beaches (16,17,21) exposed only to the south-west, but farther south the coast becomes more open and the sandy beaches (18,19,20) include rocky outcrops.

The 21 sites cover the range of variations which may be expected in the intertidal sand habitat for this part of the world. Appendix Table I lists data on positions of main sampling stations with details of soil characteristics, temperature and salinity at the times of survey for all beaches examined.

The tides in the north and west coast of Scotland are semi-diurnal with small diurnal inequality. The mean tidal range is of the order of 1.7-3.0 m with a mean of 2.5 m. Most of the beaches showed a broken profile roughly separated by MTL into an upper steep beach, followed by a lower flat foreshore, often undulating, with one or more runnels and ridges between MTL and MLWN level. The more sheltered beaches sloped into a shallow sublittoral shelf of variable breadth and angle where part of the energy of the incoming waves was dissipated.

The median diameter of the sand grains varies (apart from isolated pockets of unusually fine or coarse material) between 135 and 410 μm (Fig. 2). The grain size on these beaches depends largely on the degree of exposure to wave action, and in general the median diameter on the more exposed locations was over 220 μm, and less than this in more sheltered areas. Usually the finest grades were found on the lower parts of the beaches, with the area between about mid tide level and low water springs comparatively uniform. The sand was in most places well sorted, and the silt-clay fraction was negligible. There was usually little vertical stratification of either grain size or sorting, except in some places where recent deposition or erosion resulted in differences between the top 5 or 10 cm, and the layers below.

Temperatures just below the sand surface (Table I) had a more restricted range than the air temperatures but tended to show more variation than sea temperatures because of short term effects during immersion. In general, sand temperatures below about 2° C were seldom recorded except occasionally near high water mark in winter, while temperatures as high as 20° C were found only in the upper few centimetres after exposure to strong sunlight. Along the north coast and in the Clyde area the lowest tides are in the evening and morning, but on most of the beaches examined on the west coast proper extreme low water occurred during the night and in the early afternoon and so such areas could be exposed to extremes of temperature.

The water table varied in depth, but in general during ebb the upper part of most beaches dried up. At MTL and lower levels wet conditions prevailed, with surface water of variable depth being retained between ripple marks and runnels mainly on sheltered beaches which had a low gradient.

The sea water salinities (Table I) are normally in the range 34-35‰ and water covering the beaches during high tides was usually of this order, although in situations with high freshwater run-off, especially in confined areas, low salinity surface water at times influenced the beach. Salinity values of the interstitial water remained high, though a substantial decrease coming from land drainage was noticeable at the deeper layers of extreme high water and near the surface at mid tide and lower levels. Streams confined to channels on the beach have only local effect. Under certain conditions they may spread out and form a sheet on level ground, and this, together with freshwater seepage from the ground water table or from brackish pools, and the effects of heavy rainfall, can sometimes cause considerable reductions in salinity on parts of the beach. Except for such short term local effects, the salinities of interstitial water on the beach were seldom below 30‰.

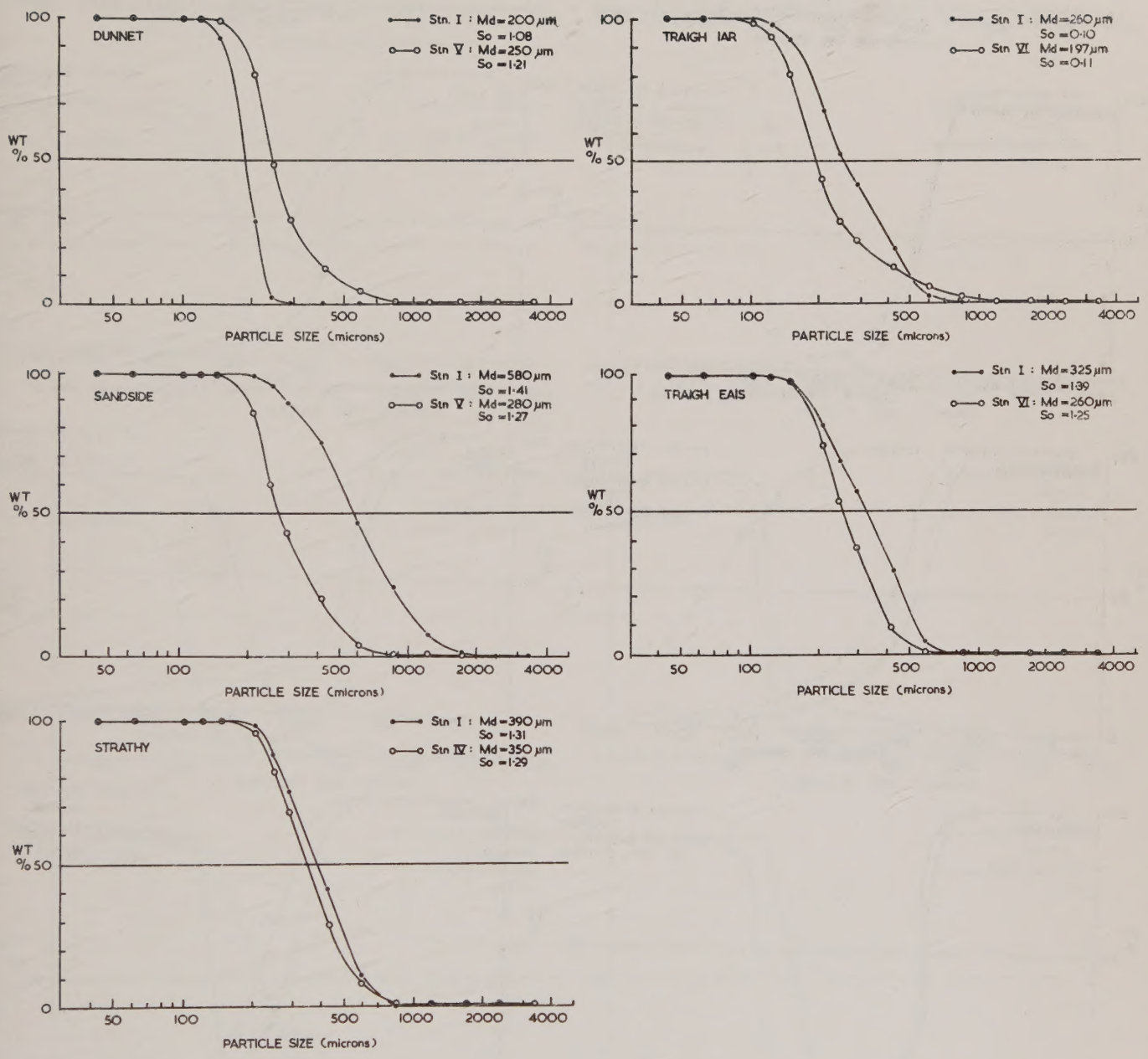

Figure 2. Cumulative curves of particle size, selected to show the extreme range encountered on each beach. a. Exposed beaches. b. Semi-exposed beaches. c. Sheltered beaches. Md = median diameter of particles, So = sorting coefficient.

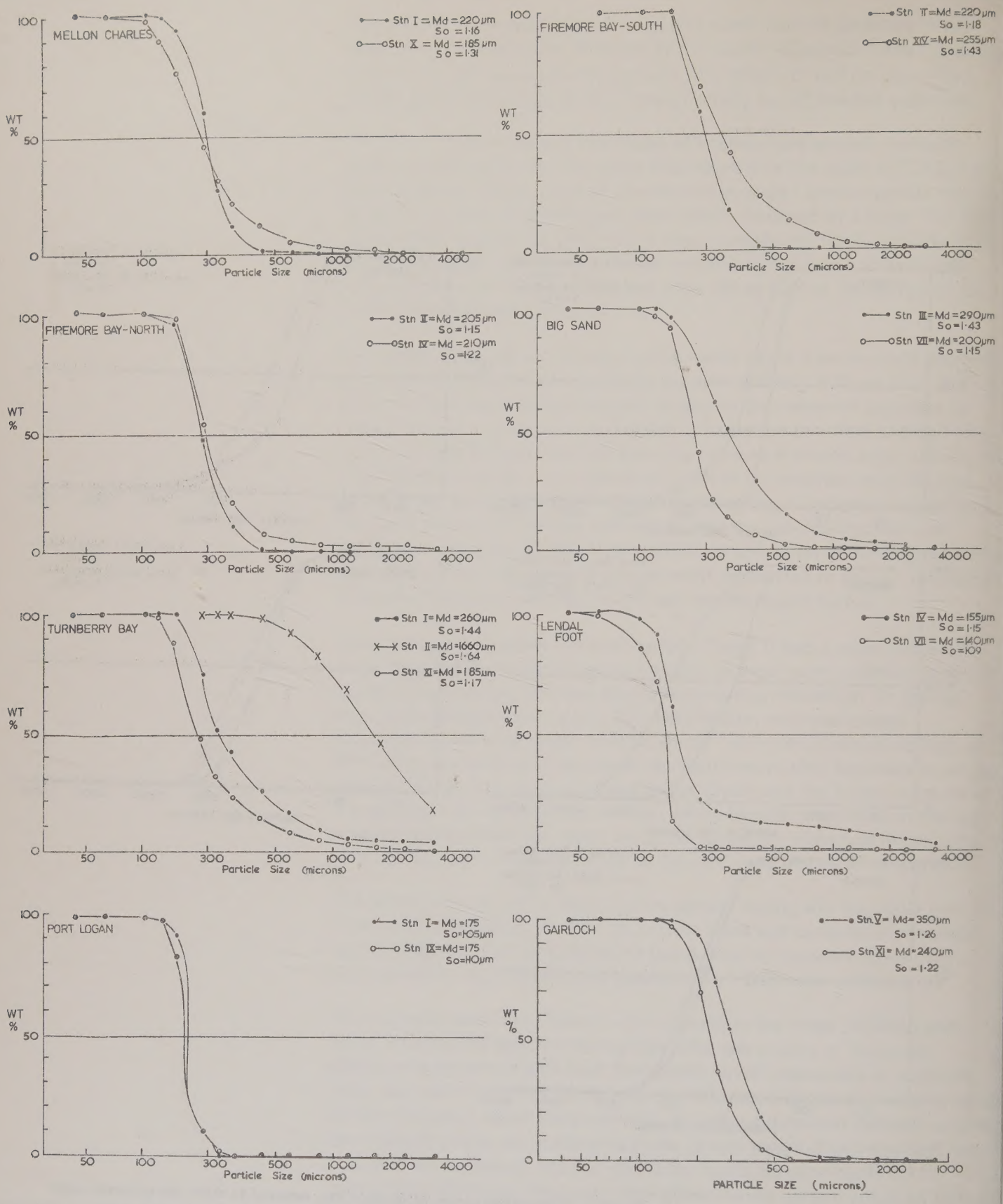
MELLON CHARLES
Stn I = Md = 220 µm So = 1·16
Stn X = Md = 185 µm So = 1·31
FIREMORE BAY-SOUTH
Stn II = Md = 220 µm So = 1·18
Stn XIV = Md = 255 µm So = 1·43
FIREMORE BAY-NORTH
Stn II = Md = 205 µm So = 1·15
Stn IV = Md = 210 µm So = 1·22
BIG SAND
Stn III = Md = 290 µm So = 1·43
Stn VIII = Md = 200 µm So = 1·15
TURNBERRY BAY
Stn I = Md = 260 µm So = 1·44
Stn II = Md = 1660 µm So = 1·64
Stn XI = Md = 185 µm So = 1·17
LENDAL FOOT
Stn IV = Md = 155 µm So = 1·15
Stn VII = Md = 140 µm So = 1·09
PORT LOGAN
Stn I = Md = 175 So = 1·05 µm
Stn IX = Md = 175 So = 1·0 µm
GAIRLOCH
Stn V = Md = 350 µm So = 1·26
Stn XI = Md = 240 µm So = 1·22
WT %
Particle Size (microns)
PARTICLE SIZE (microns)

Figure 2. *(continued).* **Cumulative curves of particle size, selected to show the extreme range encountered on each beach. a. Exposed beaches. b. Semi-exposed beaches. c. Sheltered beaches. Md = median diameter of particles, So = sorting coefficient.**

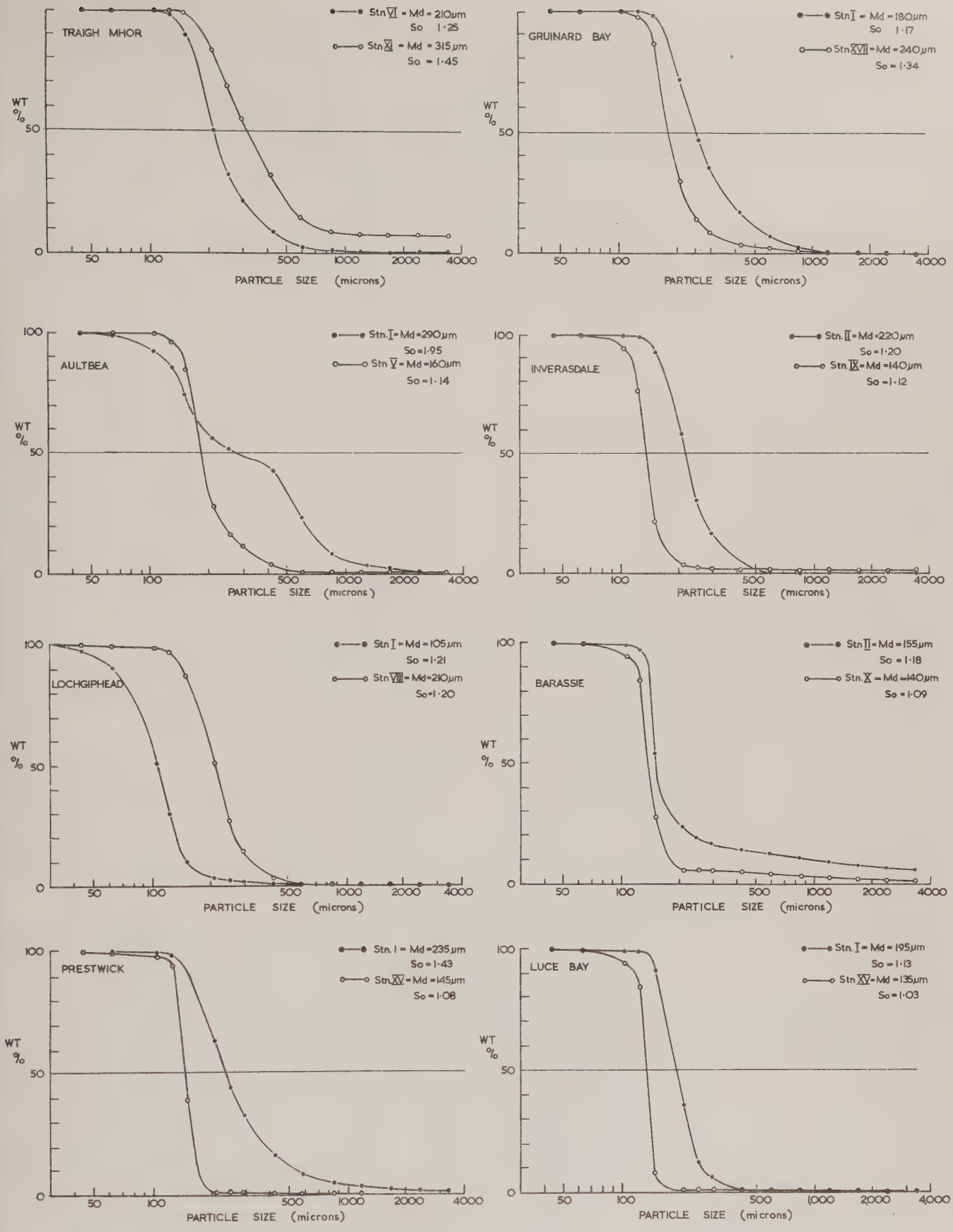
TRAIGH MHOR
Stn VI = Md = 210μm So 1·25
Stn XI = Md = 315μm So = 1·45
GRUINARD BAY
Stn I = Md = 180μm So 1·17
Stn XVII = Md = 240μm So = 1·34
AULTBEA
Stn. I = Md = 290μm So = 1·95
Stn V = Md = 160μm So = 1·14
INVERASDALE
Stn. II = Md = 220μm So = 1·20
Stn IX = Md = 140μm So = 1·12
LOCHGIPHEAD
Stn I = Md = 105μm So = 1·21
Stn VIII = Md = 210μm So = 1·20
BARASSIE
Stn II = Md = 155μm So = 1·18
Stn X = Md = 140μm So = 1·09
PRESTWICK
Stn. I = Md = 235μm So = 1·43
Stn XV = Md = 145μm So = 1·08
LUCE BAY
Stn I = Md = 195μm So = 1·13
Stn XV = Md = 135μm So = 1·03
WT %
PARTICLE SIZE (microns)
50
100
500
1000
2000
4000

Figure 2 *(continued).* **Cumulative curves of particle size, selected to show the extreme range encountered on each beach. a. Exposed beaches. b. Semi-exposed beaches. c. Sheltered beaches. Md =median diameter of particles, So = sorting coefficient.**

Dunnet (Fig. 3)

Physical features. This is the largest sandy beach in the area, stretching for 3 km east of Thurso. It is a shallow bay with a broad opening which allows oceanic swell to enter, affecting mainly the southern and south-western reaches of the long beach. The beach is stable and supplied continuously with sediment from the shallow sublittoral (Ritchie and Mather, 1970). The steep berm formed a continuation of the sand dunes of the backshore, from which a few freshwater streams enter the beach. The sand along the main traverse was fine and well sorted, (Fig. 2; Table I), with no vertical stratification of the grades at any station along the main traverse. Sand from secondary positions south-west of the main traverse was coarser and less well sorted, with a substantial vertical stratification, the coarser grades lying in the deeper layer, below 10 cm.

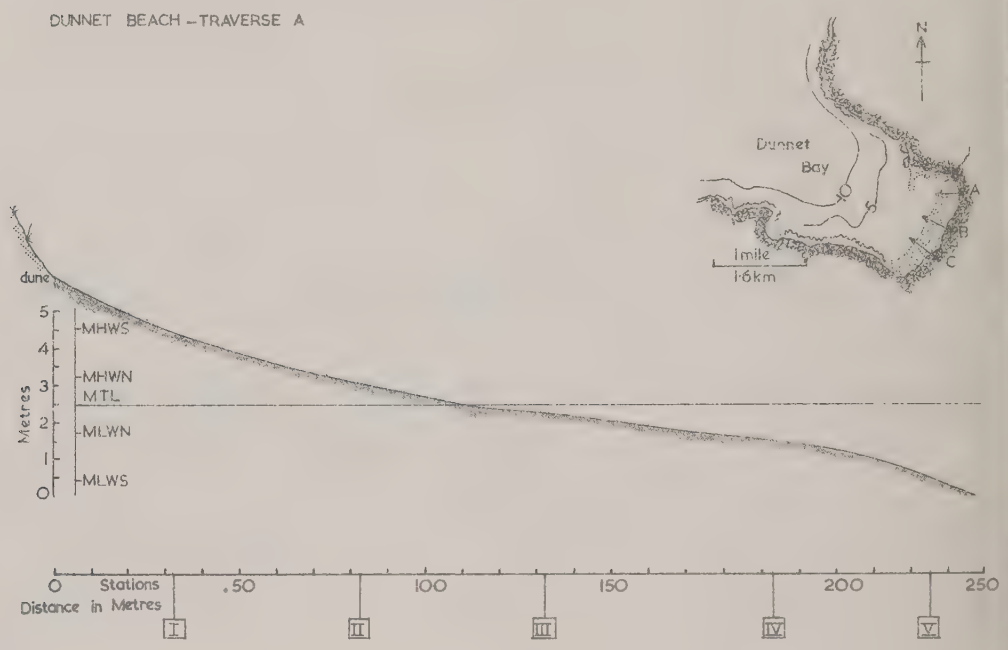

Figure 3. Dunnet beach profile, showing tidal levels and position of sampling stations. Map shows location of sampling traverses.

Fauna. A total of ten species (excluding insects) was collected in quadrats on this beach (Table II). *Talitrus saltator* contributed substantially to the population, by both numbers and weight, but was confined to the supralittoral fringe. On the beach proper only *Pontocrates, Nerine* and *Paraonis* were present in significant numbers, and only *Nerine* between MHWN and MTL made a major contribution to the biomass. A secondary traverse produced the same species with a similar distribution, and digging generally over the beach added only a few specimens of *Nephtys cirrosa* and *N.hombergi.* No other live animals were found on the beach but large numbers of lamellibranch valves were common, particularly *Mactra corallina, Donax vittatus* and *Venus striatula.*

Sandside (Fig. 4)

Physical features. This small bay lies a short distance from the experimental nuclear station of Dounreay. Although partly enclosed, it receives little protection from the rocky sides of the broad inlet, and the entire beach is unstable, affected by considerable direct or reflected wave action (Ritchie and Mather, 1970).

The intertidal area is predominantly sandy but a layer of stones and glacially derived shingle (Ritchie and Mather, 1970) lying a few centimetres below the surface, was present in parts of the lower foreshore.

Both MTL a number of shallow runnels retained water throughout the ebb. A more pronounced runnel and ridge system immediately below MLWS made this area difficult to sample adequately.

The grades were well sorted, particularly near low water (Fig. 2; Table I). There was some vertical stratification, with the finer and better sorted grades lying deeper than 10 cm.

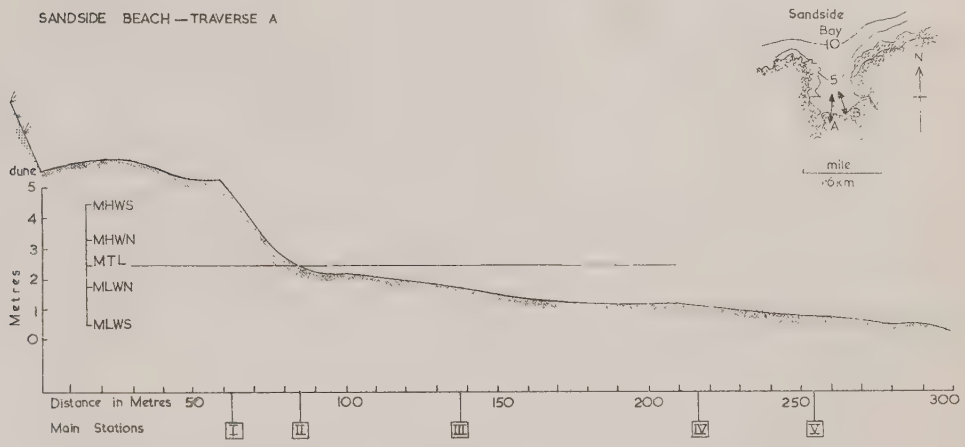

Figure 4. Sandside beach profile. Details as in Figure 3.

Fauna. Sixteen species were collected (Table III). The fauna was sparse, with only very low numbers of *Pontocrates, Eurydice, Paraonis* and the archiannelid *Protodrilus.* Biomass was particularly low, except where an occasional large specimen of *Nephtys cirrosa* was found. The only other organisms found on general surveys outside the main traverse were *Arenicola marina* in small numbers and *Ammodytes.* Although the beach was carefully searched, not even dead shells of almellibranchs were found.

Strathy (Fig. 5)

Physical features. This bay is a typical pocket beach confined by steep cliffs and facing directly into the open sea. The long rocky headland at the west side of the beach offers only limited protection from north-east winds and none from the Atlantic swell. A large stream entered the beach at the western corner and fanned out to produce a substantial delta. An extensive ridge system lay below MTL, replaced by an undulating profile where surface water was retained in the runnels.

The sand was clean with a small amount of shell debris, and moderately well sorted (Fig. 2; Table I). There was no evidence of substantial grade stratification, although in the lower stations the surface layers were rather finer and better sorted.

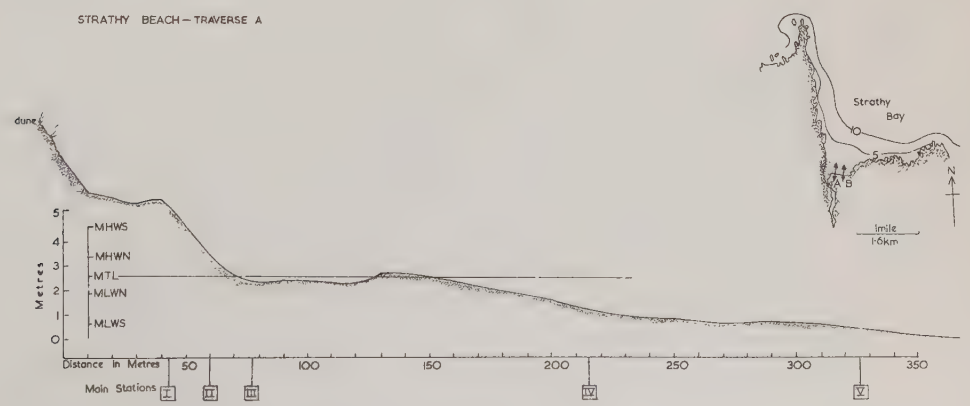

Figure 5. Strathy beach profile. Details as in Figure 3.

Fauna. Of the nine species collected along the main traverse only the two crustaceans *Pontocrates norvegicus* and *Eurydice* occurred in moderate numbers (Table IV). The secondary traverse gave similar results, although *Paraonis* was rather more numerous there. A single live specimen of *Tellina tenuis* was found on the main traverse, but general digging over the rest of the beach produced no further specimens, nor indeed any other living mollusc, although single valves of juvenile *Spisula elliptica* and *Thracia* spp. were common in the sand.

Traigh Iar (Fig. 6)

Physical features. This sandy beach extends for about 2.5 km on the north coast of North Uist. The beach profile showed two depressions, the first at the level of MHWN and the second at MLWN, which created an undulating profile at the middle and upper beach. No freshwater stream entered the beach, though land drainage from the dunes was noticeable.

The sediments at all levels and depths were well sorted, but the distribution of grades showed a transition from coarser, in the upper beach, to finer in the lower beach (Fig. 2; Table I). There was also a vertical gradient in the middle and lower beach with the finer grades at the surface. The upper foreshore remained dry, but below mid tide surface water was present in all stations.

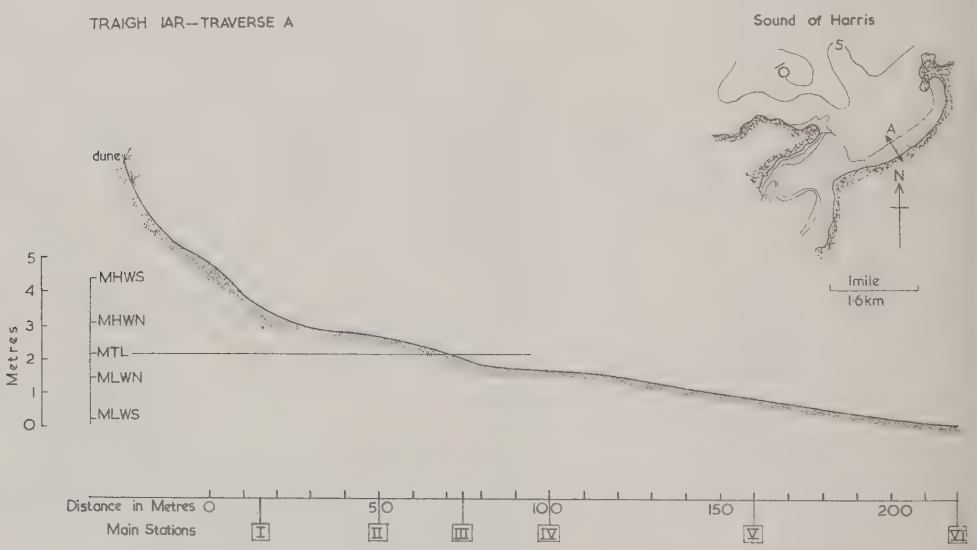

Figure 6. Traigh Iar beach profile. Details as in Figure 3.

Fauna. Twelve species were recorded from the beach (Table V), but the fauna was very sparse indeed, with *Bathyporeia pelagica* and *Pontocrates* being most numerous. Molluscs were absent, and no shells were found on the beach. The mean biomass (0.1 g m^{-2}) was lower than on any of the other beaches examined.

Traigh Eais (Fig. 7)

Physical features. This beach, 2.5 km long on the west coast of Barra is a true oceanic beach, completely open to the prevailing winds and Atlantic swell. It is frequently eroded (Ritchie, 1971), being continuously supplied with sediment from the shallow sublittoral. A small stream entered the beach centrally at the time of sampling; dry beds of freshwater streams indicated a large seasonal freshwater influx. The sand, loose at the upper shore, was well packed at lower levels and contained some fine shell fragments. In the middle and lower shore the grades were rather fine, but the upper shore was rather coarser and less well sorted (Fig. 2; Table I). In all stations the subsurface layer (5-8 cm) was finer than the surface layer, suggesting abrupt changes in the hydrodynamic balance on this beach. Deeper still, the layers tended to be coarser, except at HWN.

The upper shore remained noticeably dry, but below this level the sand remained saturated with surface water.

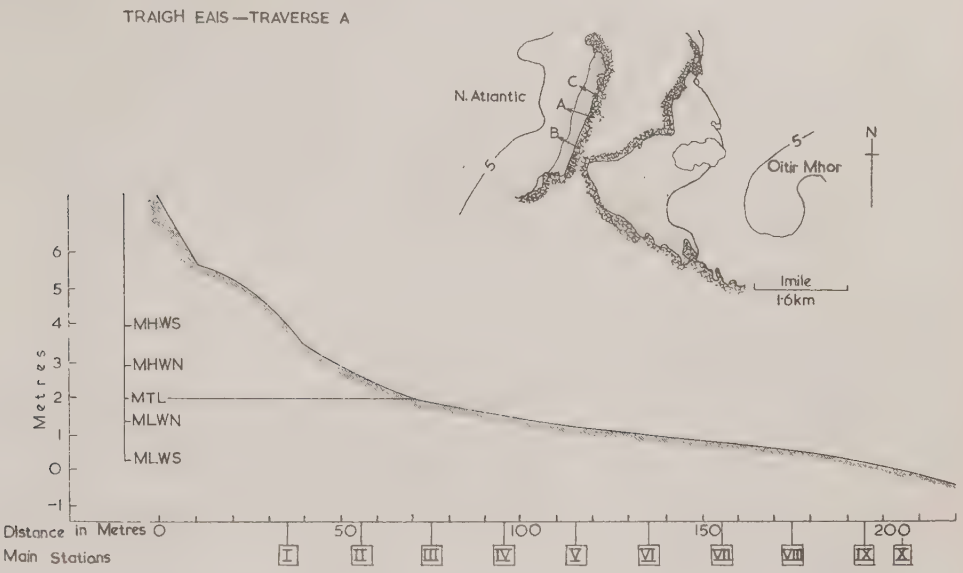

Figure 7. Traigh Eais beach profile. Details as in Figure 3.

Fauna. A total of 15 species was collected (Table VI), and again the fauna was very sparse, consisting mainly of *Pontocrates norvegicus* and *Bathyporeia. B. pelagica* was comparatively numerous, particularly at and just below MLWN, where densities of over 2000 m^{-2} were recorded. A number of polychaete species was found in the upper part of the beach above mean tide level, but this was probably a result of wave action.

Discussion - Exposed Beaches

The first five beaches described are all in extremely exposed situations, open to severe wave action, and even in calm weather subject to considerable swell. They show a combination of characteristics which may be regarded as typical of such exposed beaches.

The profile, in the upper part of the beach at least, tends to be steep, and the sand is in general very well sorted, with the median diameter ranging mostly between 200 and 400 μm. This is followed by a flat lower foreshore with a variable texture. The fauna was of very low diversity and consisted largely of small crustaceans (which were numerically dominant) and polychaetes. The bulk of the fauna was distributed on the comparatively level area between mid tide level and the low water mark, and in this zone the crustaceans made up 52-98% of the fauna numerically, but the polychaetes, because of their greater size, usually contributed 42-77% of the dry weight. The populations consist essentially of the amphipod *Pontocrates norvegicus,* the isopod *Eurydice pulchra* and the polychaetes *Nerine cirratulus, Paraonis fulgens* and *Nephtys cirrosa.* These five species are usually joined by one or two others, chiefly *Bathyporeia pelagica, B. pilosa* and *Haustorius arenarius* (amphipods); *Ophelia rathkei, Eteone* sp., *Phyllodoce* sp and a small capitellid (polychaetes); and a small nemertine. This group of 13 species may be said to constitute the fauna of the exposed beaches, from mid tide level downwards. Total fauna numbers at individual stations in this zone usually range from 64 to 832 m^{-2}, although this maximum may be exceeded in local concentrations of single species such as *B. pelagica.* Comparable biomass values for individual stations range from 0.04 to 1.42 g dry weight m^{-2}, with a mean of 0.428 g m^{-2}, and this range is exceeded only when an occasional large *Nephtys* or an exceptional concentration of *Nerine* is found, or when a sandeel is collected — an animal regularly buried in the sand which is probably not a part of the sand food web, since the stomachs of these buried *Ammodytes* always contained planktonic copepods.

Higher on the exposed beach, above mid tide level, the fauna is even more sparse. This part is usually steep and comparatively dry, and apart from the amphipod *Talitrus saltator* near the high water mark and some oligochaetes usually associated with areas of reduced salinity the biomass is insignificant. Occasionally species which usually occur at much lower tidal levels were found high on the beach owing to misplacement through severe wave action.

The almost complete absence of molluscs is a characteristic feature of these exposed beaches. On all areas examined only a single living specimen of lamellibranch *(Tellina tenuis)* was collected,in spite of an extensive search for molluscs.

Section II - Moderately Exposed Beaches

Mellon Charles (Fig. 8)

Physical features. This is a small pocket beach on the north-eastern shore of Loch Ewe. Since it is open to the west and south-west it is exposed to the prevailing winds, and although there is a limited fetch it is considerably affected by wave action and swell. Nevertheless, there is evidence that the beach is stable (Crofts and Mather, 1972) over prolonged periods.

A small stream enters at the eastern corner, while in the middle of the beach there is some effluent from a small storm-water drain.

The sand along the main traverse was fine and well sorted (Fig. 2; Table I) and there was a sediment gradient, with the finer grades found at the lower foreshore. Sand at the western side of the beach was finer overall and better sorted than the main traverse.

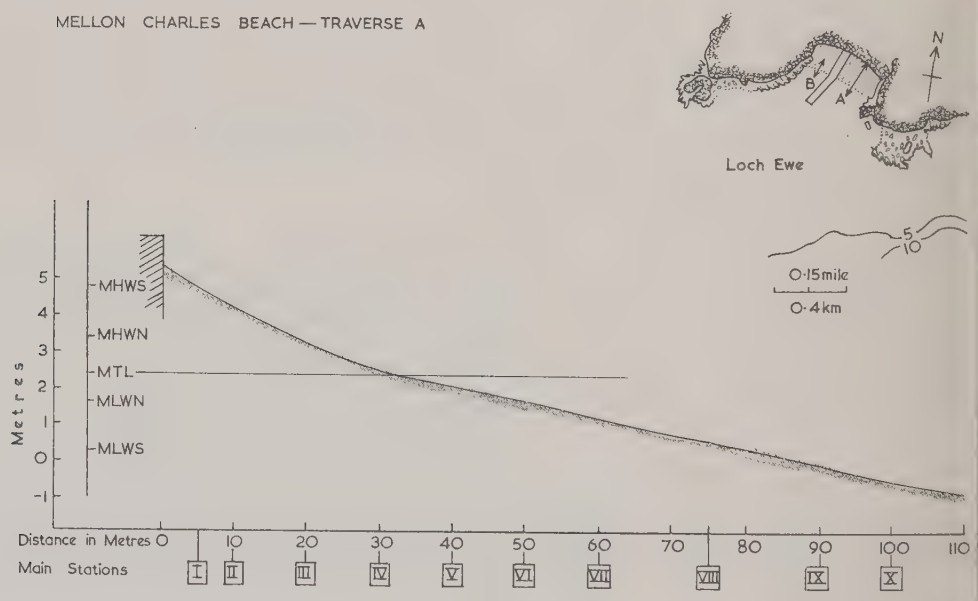

Figure 8. Mellon Charles beach profile. Details as in Figure 3.

Fauna. A total of 21 species (excluding insects) was recorded (Table VII), but on the main traverse only a few of these were present in high numbers, and they showed a distinct zonation – oligochaetes on the upper part of the beach, *Bathyporeia pilosa* and *Nerine cirratulus* from MTL to just below MLWN, and *Tellina tenuis* at low water. Sampling on each side of the main traverse gave similar results, except that a few specimens of *Tellina fabula* were collected.

Although the biomass at most stations was low it exceeded 3 g m^{-2} at low water, where *Tellina* was common, and again at around MLWN where *Nerine* was abundant, in particular where most of these polychaetes were mature.

Firemore Bay, South (Fig. 9)

Physical features. Firemore is a sandy bay, well delimited by rocky headlands, on the south-west shore of Loch Ewe. It is divided by a peninsula into two parts which, for the purpose of the present survey, are called Firemore South and North. Firemore South is the more exposed part and is particularly affected by north winds and swell, but is sheltered from the prevailing south-westerly winds. A stream enters the beach roughly in the middle, creating an extensive delta at LW. The beach is relatively stable, although erosion by the stream causes considerable changes (Crofts and Mather, 1972).

The beach was surveyed intensively as part of a general ecological study (McIntyre and Eleftheriou, 1968) but only one main traverse is considered here for comparison with the other areas.

The sediments along the transect were fine overall and well sorted (Fig. 2; Table I). There was very little stratification in the sediments on the upper beach, but below mid tide some stratification was found, with the coarser grades, including a certain amount of shell debris and stones lying deeper.

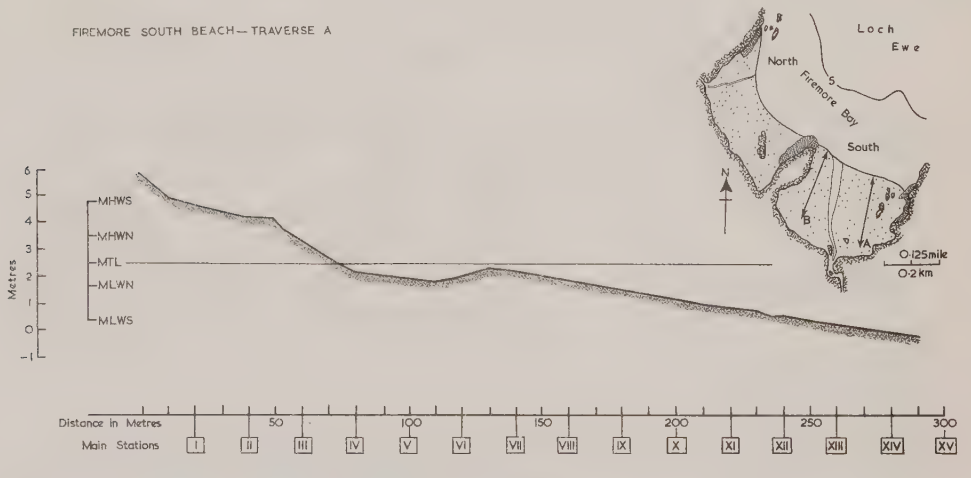

Figure 9. Firemore South beach profile. Details as in Figure 3.

Fauna. The fauna along the main traverse included 17 species (excluding insects), with *Nerine* and *Ophelia* dominant (Table VIII). Additional species were present at the lateral stations or secondary traverses. Some of these, such as *Siphonoecetes delavallei, Atylus swammerdami, Pontocrates arenarius,* juvenile forms of *Gammarus locusta,* mysids, Cumacea and Decapoda (mainly *Crangon*) as well as *Arenicola marina* and Phyllodocidae were widely distributed and locally abundant. A smaller number, such as *Bathyporeia guilliamsoniana, Glycera lapidum* and *Magelona papillicornis,* were sporadically present on the beach.

The upper part of the beach was devoid of any fauna as a result of the sediment instability and freshwater dilution typical of this level. The presence of a pool below mid tide had a selective influence on the intertidal fauna.

Firemore Bay, North (Fig. 10)

Physical features. This part of the bay, which lies between the dividing central promontory and the northern rocky coast, is well sheltered from winds of most directions, but is somewhat affected by wave reflection and swell.

A small permanent stream enters at the northermost corner of the steep beach, and there are several smaller seasonal fresh water channels.

As with the south beach, two main traverses and many subsidiary stations were worked as part of a larger study, (McIntyre and Eleftheriou, 1968) but only one traverse is considered in detail here.

The beach consisted mainly of clean sand with a small quantity of fine shell fragments. The sand along the traverse was fine overall and well sorted, with the finer sediments found on the upper half of the foreshore (Fig. 2; Table I). There was evidence of grade stratification, with the coarser and less well-sorted grades (which included quantities of shell fragments) lying in deeper strata.

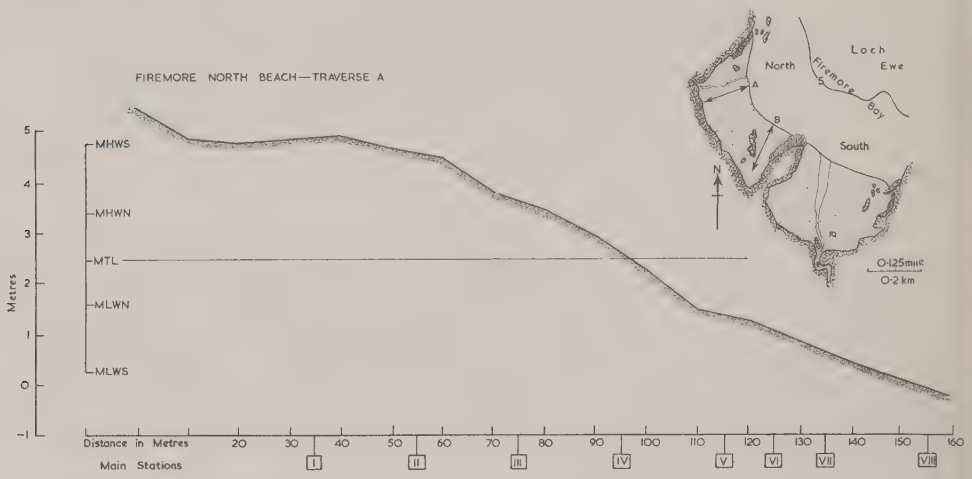

Figure 10. Firemore North beach profile. Details as in Figure 3.

Fauna. Twenty-nine species of animals were recorded along the main traverse (Table IX). Others, including amphipods *(Amphithoe rubricata,* Caprellidae, Stenothoidae, Ischyroceridae and Talitridae), polychaetes and molluscs (bivalves and gastropods), as well as a number of tidal migrants (decapods, mysids and sandeels), were also present on lateral stations or secondary transects. A more detailed list is given in McIntyre and Eleftheriou (1968).

The fauna mainly consisted of crustaceans *(Eurydice, Atylus,* and *Bathyporeia)* polychaetes *(Nerine, Nephtys)* and *Tellina tenuis* which occurred in high densities (480 m^{-2}) contributing most to the total biomass. The upper level lying between MHWS and MHWN, an area of considerable instability, was colonised only by a small population of talitrids and oligochaetes. In the berm, oligochaetes and insect larvae were present, mostly in low densities.

The main traverse was representative of the northern part of the bay, but the southern end, near the central peninsula, being more exposed to wave action, was noticeably poorer in both numbers and species.

Gairloch (Fig. 11)

Physical features. This beach at the head of the Loch is delimited by two headlands which offer no shelter, but the land mass of the southern shore cuts off most of the force of the south-westerly gales. Wave reflection and swell affect most of the beach except the extreme south end. The sand, smooth and dry on the upper foreshore, was wet and lined with deep ripple marks at lower levels, giving evidence of turbulence and temporary instability

The sand at the lower levels contained small amounts of shell fragments. The median diameter was fine and the sorting was good (Fig. 2; Table I). The coarsest grades were found above mid tide level but there was no evidence of vertical stratification. The grade distribution was nearly uniform, very little difference being observed in the grain size and sorting of the lateral stations.

Fauna. A total of 29 species was obtained, mostly on the main traverse (Table X), the only additions from other parts of the beach being a few specimens of *Echinocardium, Arenicola* and a burrowing anemone. Most of the fauna, both numerically and by species, occurred below MLWN. The most abundant animal was *Ophelia rathkei,* but the highest biomass was due

to the populations of *Tellina tenuis* near low water, which were dense (up to 432 m^{-2}) at lateral stations on each side of the main traverse.

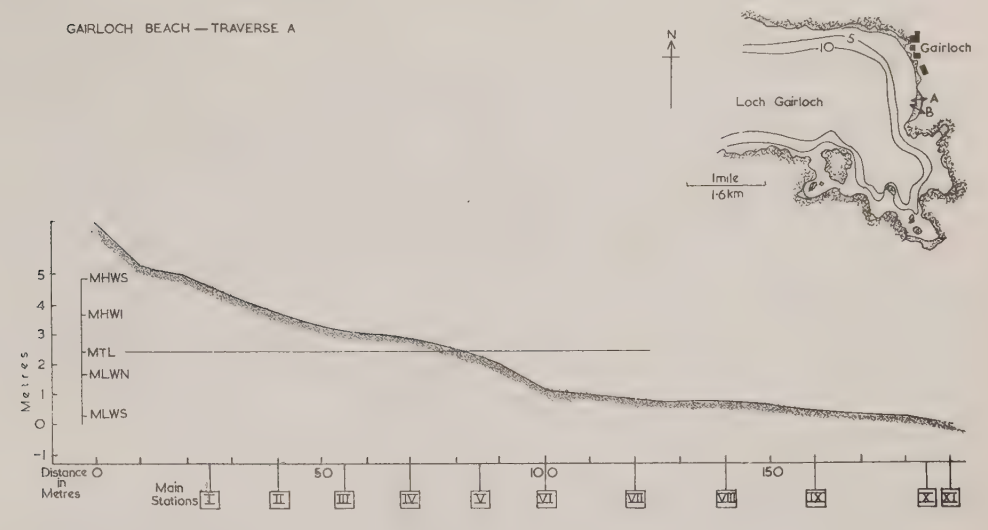

Figure 11. Gairloch beach profile. Details as in Figure 3.

Big Sand (Fig. 12)

Physical features. This beach, an outer part of Loch Gairloch, is a sandy stretch, over 2 km long. It is completely exposed except that Longa Island, from which it is separated by a narrow sound, offers some shelter from the south-westerly winds and oceanic swell.

Several small streams enter the beach, with the biggest separating the beach into two more or less equal parts.

The sand was clean with a small amount of shell fragments present in the lower foreshore. There was no evidence of vertical stratification of sediments on the lower part of the beach, but above MLWN the finer sediments tended to be at the surface (Fig. 2; Table I). The sorting of the grades at the various layers was rather variable from station to station, probably owing to the varied intensity of wave action.

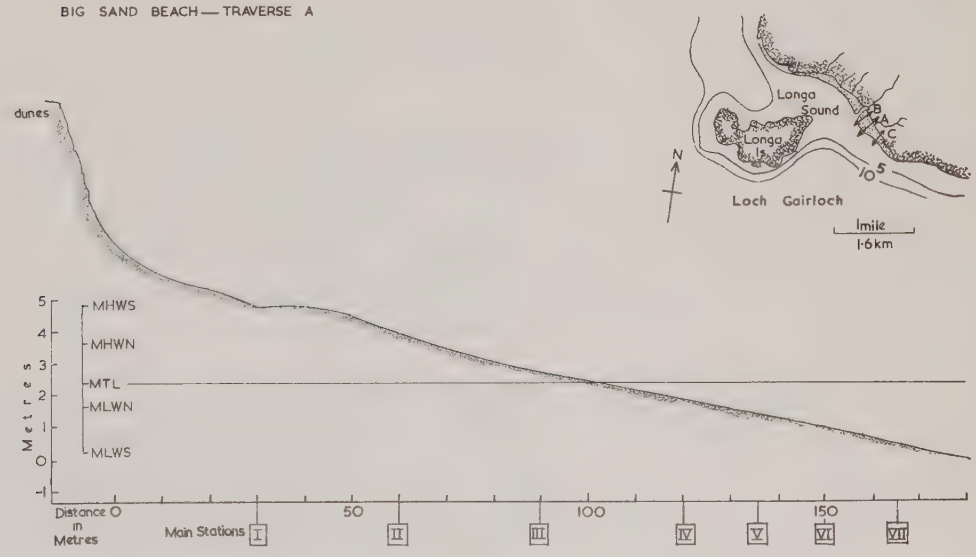

Figure 12. Big sand beach profile. Details as in Figure 3.

Fauna. A total of 21 species was found, mostly in the main traverse (Table XI). The fauna was concentrated mainly in the lower levels of the beach between MLWN and MLWS; here *Paraonis* and *Psammodrilus* were the most numerous organisms, and biomass was low. Crustaceans were poorly represented and the molluscs *Venus* and *Spisula* occurred only as

single specimens, while even the more abundant *Tellina* was present only in low densities (48 m^{-2}) although slightly higher concentrations were observed on the lateral transects.

Turnberry (Fig. 13)

Physical features. Turnberry is a small bay on the outer reaches of the Firth of Clyde, open to the west and south-west and well delimited by rocky outcrops forming small headlands. The beach stretches for 2 km between the headlands, the northern part crossed by a stream. The sand contained some shell fragments which were present mainly at MHWS. The sand above mid tide was loose and coarse but finer compact sand was present at lower levels (Fig. 2; Table I). The vertical distribution of the grades was rather variable.

Pools left at the break of the slope drained laterally through the runnel, undercutting and eroding the beach at that level, where salinities of 24-25‰ were recorded.

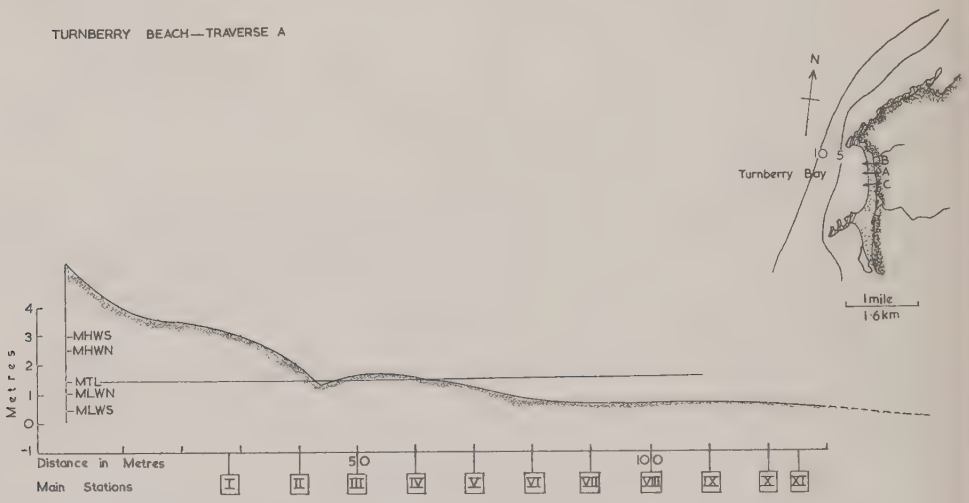

Figure 13. Turnberry beach profile. Details as in Figure 3.

Fauna. The fauna of the beach included 21 species (excluding insects) (Table XII). Talitrids in large numbers, haustoriids, oligochaetes and *Nerine* inhabited the upper part, while the biggest variety of fauna, consisting of moderate numbers of polychaetes, amphipods and bivalves, was present from MLWN downwards.

Some of the secondary traverses yielded higher densities of certain species. For example, on one lateral traverse *B. pilosa* was present at a density of 912 m^{-2}, *Haustorius* at 432 m^{-2} and *Tellina* at 432 m^{-2}. *Talitrus* mostly juveniles, and oligochaetes were responsible for high densities (22784 m^{-2}) and biomass (25.08 g m^{-2}) recorded at MHWS. Higher biomass (26 g m^{-2}), mostly due to the presence of large individuals of *Arenicola* and *Donax*, was found at lower levels.

Lendalfoot (Fig. 14)

Physical features. The bay of Lendalfoot on the outer reaches of the Firth of Clyde is composed of small sandy stretches between boulders and rocky outcrops. There is very little protection from wind and wave action, though some shelter from the prevailing winds is provided by the rocky headlands. The main traverse was near Carleton Port, with secondary traverses to the south and north spread over a mile of coastline.

The sand contained a small amount of shell as well as some algal fragments on the highest part of the beach. Patches of coarse gravel were present on the upper foreshore but there were finer grades on the lower parts of the beach (Fig. 2; Table I). Layers of coarse materials were found sandwiched between finer grades over most of the lower foreshore. Freshwater dilution was noticeable only at the upper foreshore in the vicinity of the stream which occupies the backshore.

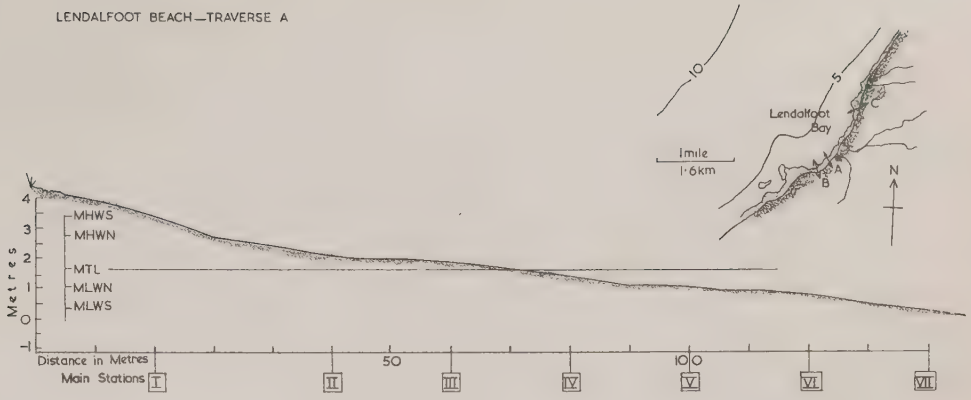

Figure 14. Lendalfoot beach profile. Details as in Figure 3.

Fauna. Of the 30 species (excluding insects) found on the main traverse (Table XIII), crustaceans and polychaetes occurred in about equal numbers and made up most of the population. Except for oligochaetes at the high tide level and *B. pelagica* round mid tide, there were no large concentrations of animals. The highest biomass (18.2 g m^{-2}) was due to *Nerine cirratulus* and *Arenicola* just above the mid tide level.

Port Logan (Fig. 15)

Physical features. This is a small pocket beach on the western side of the Mull of Galloway, exposed to westerly and south-westerly winds and wave action. Little protection is afforded by the short headlands on either side and shelter increases from north to south, corresponding to a marked gradient in soil texture.

The sand was fine and compact, with a very small amount of shell fragments (Fig. 2; Table I). A slight vertical stratification was observed only at the upper beach, where the finer sediments lay at the surface. The grades at the northern traverse ranged from patches of fine sand to gravel and small stones.

Freshwater influence was present at both ends of the beach, with salinities down to 12‰.

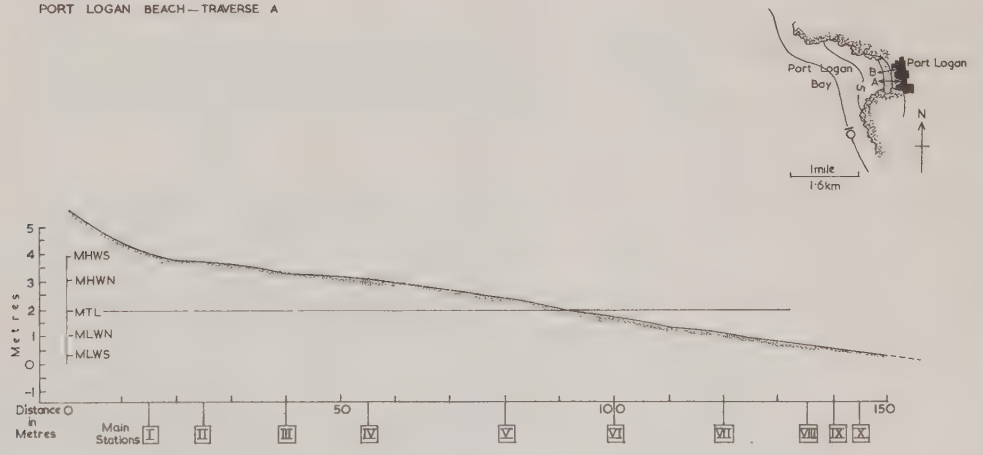

Figure 15. Port Logan beach profile. Details as in Figure 3.

Fauna. A total of 21 species was collected on the main traverse (Table XIV) and seven more, *Urothoe elegans, Nerine cirratulus, Spiophanes bombyx, Polydora* sp., *Nephtys hombergi, Eteone* sp. and *Ammodytes* sp., were found on the secondary western line. Although oligochaetes at the high water mark were the most numerous animals at any single station, amphipods

were generally more abundant, particularly *B. pelagica, B. pilosa* and *Haustorius arenarius.* It is of interest that because of the unusual configuration of this beach, with a flat stretch above mid tide level, the bulk of the crustaceans occurred on the higher part of the beach. Although polychaetes were much less numerous, they made up the greatest part of the biomass owing to small numbers of *Nephtys* and *Arenicola.*

Discussion - Moderately Exposed Beaches

The eight beaches described in this section are either inside sea lochs or are at least partially protected by islands or other land masses, and can therefore be regarded as more sheltered than the open beaches dealt with in Section I. The profiles of these moderately exposed beaches tend to be less steep than those of the exposed ones, and the sand finer, mostly between 155 and 250 μm median diameter but again usually very well sorted.

As before, most of the fauna consisted numerically of crustaceans and polychaetes. Those species found to be dominant on the exposed beaches were also dominant on moderately exposed beaches. Their numbers however were generally much greater and several additional species were present, in particular the amphipod *Atylus swammerdami* and the polychaetes *Pygospio elegans, Spio filicornis, Magelona papillicornis, Scoloplos armiger, Chaetozone setosa, Euzonus flabellifera, Travisia forbesi, Sigalion mathildae, Nephtys hombergi* and *Glycera* sp. Perhaps the most striking change with increased shelter however, is the appearance of significant lamellibranch populations. In particular, *Tellina tenuis* was found on most of the moderately exposed beaches from about MLWN downwards, with maximum numbers occurring at low water.

Although there is perhaps a tendency for increased density of fauna above the mid tide line, most of the animals are still in the zone from mid tide to low water, where numerically crustaceans made up 24-59% of the fauna and polychaetes 22-70%. Total fauna numbers at individual stations in this area range from 160 to 3824 individuals m^{-2} and biomass from 0.14 to 7.65 g m^{-2} dry weight, with a mean of 1.77 g m^{-2}. In spite of their small numbers, *T. tenuis* contributed from 4 to 88% of the total biomass.

The upper part of the beach around MHWS was occupied mainly by oligochaetes and crustaceans, especially *Bathyporeia pilosa* and *B. pelagica.*

Section III - Sheltered Beaches

Traigh Mhor (Fig. 16)

Physical features. This extensive beach on the Island of Barra faces the Minch, and although it is separated from the Atlantic only by a narrow strip of coast and sand dunes, land masses and small islands afford considerable shelter to the beach, which is affected only by winds and wave action with rather limited fetch (Ritchie, 1971).

There is no berm and the upper foreshore is steep, followed by an extensive (1.6 km from HW to LWM) and very gently sloping beach. Runnels and ridges run parallel to the shore, with the runnels retaining water which drains from the upper reaches.

The sand was hard packed at the upper reaches, containing a large quantity of shell, though it was loose at the lower levels, with fewer but larger shell fragments and often entire valves of molluscs. As the rocky sublittoral contributes nothing to the building of the beach a large percentage of the sand was biogenic in origin, the rest being supplied by Aeolian deposition from the adjacent intertidal areas to the north.

Only the outer part of the beach was worked as it was not possible to sample the inner part, which is used as a landing strip for commercial aircraft.

The sediments were well sorted, but owing to the presence of large and heavy shell fragments some stations had a rather high median diameter (Fig. 2; Table I). There was a pronounced vertical gradient with the coarser grades lying in the deeper layers.

The presence of a permanent layer of surface water and the absence of any large body of fresh water having an extensive influence on the beach resulted in a temperature range very similar to sea temperatures and in uniformly high salinities in the centre part of the beach.

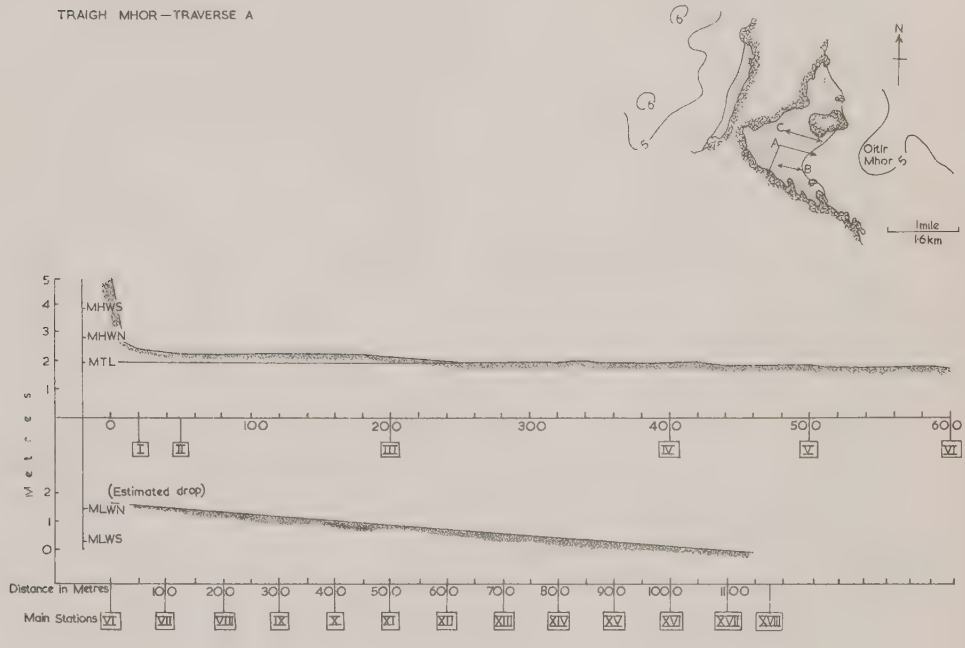

Figure 16. Traigh Mhor beach profile. Details as in Figure 3.

Fauna. Traigh Mhor is a typical cockle beach, with empty valves and shell fragments all over the area and live cockles giving evidence of a thriving cockle community. Less conspicuous species are also numerous, and a total of 44 was collected (Table XIV). More than half of these were polychaetes, with a clear predominance of sedentary types.

These large numbers of small polychaetes, errant and sedentary, particularly *Pygospio elegans* and *Chaetozone setosa,* which were very abundant, may be accounted for by the large amount of shell fragments giving the sediment stability and creating a habitat where food and fine particles were trapped.

Of lamellibranch species, all except *Cerastoderma edule* were confined to the lower shore between mid tide and low water springs. *Cerastoderma* was widely distributed from MHWN to MLWS, and its density varied along both traverses, from single specimens at the end station of its distribution to a maximum of 224 m^{-2} at MLWN. A percentage of the population consisted of juvenile individuals, which are present mainly at the upper stations.

The numbers of individuals ranged from 688 m^{-2} at mid tide level to 10,240 m^{-2} at just below MHWN, the maximum being due mainly to oligochaetes.

Biomass values were mostly high, ranging between 0.55 g m^{-2} a little below MHWN to over 55 g m^{-2} in the middle of the beach. The biomass at any station was chiefly influenced by the abundance of molluscs, particularly *Cerastoderma.*

Gruinard Bay (Fig. 17)

Physical features. This large shallow bay joins the North Minch by an opening common to Gruinard, Loch Broom and Little Loch Broom. Though the bay is open to north and north-easterly winds, some shelter is provided especially at the northern half of the beach by Gruinard Island and by a small rocky promontory at the northern shore of the bay. Two small rivers enter at the south side and south-western corner and cross the main traverse below mid tide giving an irregular profile to the beach.

The sand contained small amounts of shell fragments. A dark odourless layer including organic debris partly of terrestrial origin was localised at the deeper layers of the sediment at low water mark. The sand was fine over all and was well sorted (Fig. 2; Table I). There was a definite gradient with the coarser grades lying at the upper foreshore. This pattern was upset in the middle of the beach by the stream.

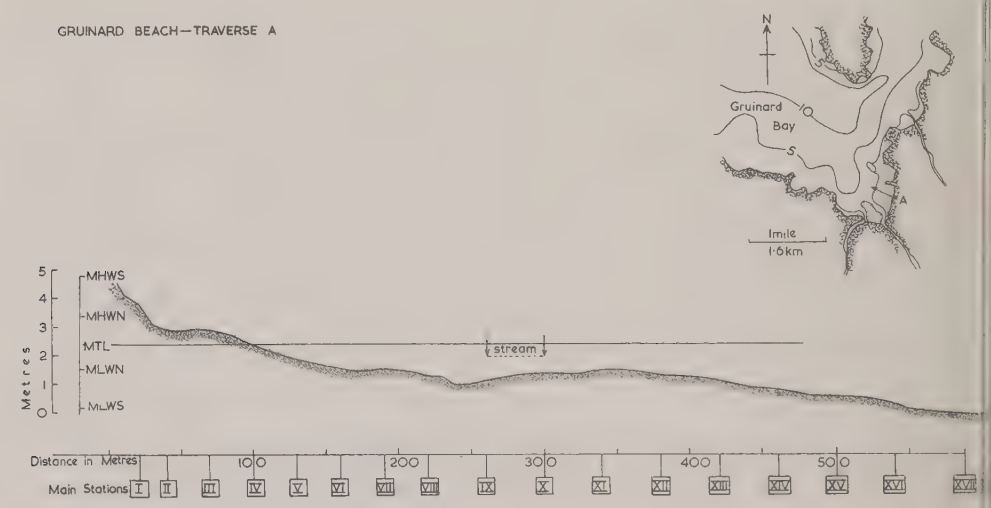

Figure 17. Gruinard beach profile. Details as in Figure 3.

Fauna. A total of 35 species was collected on the main traverse (Table XVI), consisting mostly of crustaceans and polychaetes. A paucity in species and numbers observed in the vicinity of the stream must be associated with the presence of fresh water as well as the instability of the environment, although Crustacea, in particular *Eurydice* and *Bathyporeia* spp., highly agile organisms and strong swimmers, were less affected by the stream, and therefore their distribution was more regular than was that of polychaetes. Several species of Crustacea *(Bathyporeia pilosa, B. pelagica, Eurydice)* and polychaetes *(Ophelia, Spio,* Capitellidae) were present in large densities ranging from 1100 to 2500 m^{-2}.

Total numbers in some stations were as high as 6272 m^{-2}, but considerable fluctuations were found, especially in the area around and above the stream, the area of maximum instability.

The mean total biomass along the traverse was 5.9 g m^{-2}, and molluscs were the most important group, contributing 72.5%.

Aultbea (Fig. 18)

Physical features. This is a small crescent-shaped beach on the north eastern shore of Loch Ewe, opening into the narrow sound north of the Isle of Ewe. A promontory and the Isle of Ewe shelter the beach to a great extent from the prevailing winds and wave action. Only part of the western end of the beach is sandy, while boulders constitute the eastern part.

All along the steep and irregular upper foreshore between MHWS and MLWN is an unbroken zone of stones and boulders covered with a growth of brown algae *(Pelvetia, Fucus, Ascophyllum).* Only the sand flat below MLWN was sampled, one main traverse and a number of lateral stations being worked.

The sand along the main traverse was finest and best sorted near MLWS, and coarsest just below the rocks at MLWN (Fig. 2, Table I). There was no evidence of vertical stratification of the grades or difference in their sorting with depth at the lower stations, but there was a pronounced vertical stratification, with the coarser and badly sorted grades lying in deeper layers about MLWN.

At the upper foreshore land drainage was responsible for a substantial decrease in the salinity of the interstitial water.

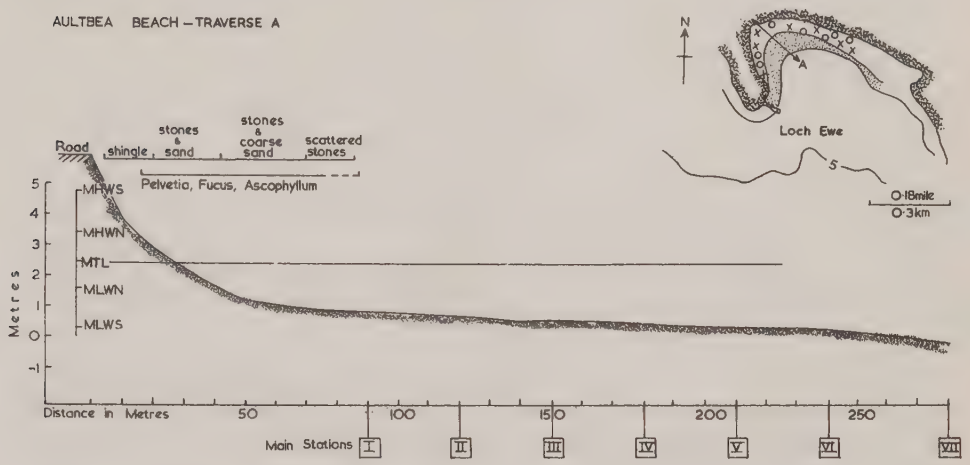

Figure 18. Aultbea beach profile. Details as in Figure 3.

Fauna. Forty-four species were collected on the sandy part of the beach (Table XVII). As a result of the small tidal range over the sandy part of the beach and the uniformity of the substratum, there was no substantial difference in the qualitative composition of the fauna in the various stations.

Polychaetes (30 species) were widely distributed and were the most important animals both in species and in numbers, with *Exogone hebes* the most numerous species.

Of several species of lamellibranchs present, *Tellina tenuis* was the dominant species, being both abundant and widely distributed. Juvenile *Tellina* were abundant in some stations, making up as much as 50% of the total molluscan population.

From the samples as well as from general digging, *Echinocardium* was found to be quite common, though its density was never higher than 1-3 m^{-2}.

Inverasdale (Fig. 19)

Physical features. This beach, situated on the south-west shore of Loch Ewe, is unaffected by the prevailing south-westerly winds, and although open to wave action from the north-east, it is sheltered by a promontory and by the Isle of Ewe.

The beach, which is fringed on either side by rocky outcrops and boulders, consists of a hard upper beach with shingle and boulders covered with a sparse growth of *Fucus serratus,* separated from the sandy lower levels by a deep runnel. The presence of shingle and boulders restricted the sampling to the sandy stretch below MLWN.

The sand contained a small amount of shell debris and at the lower levels had an important amount of organic matter with a strong smell of hydrogen sulphide. The sediments along the main traverse were fine and well sorted overall (Fig. 2, Table I). The subsurface layers, however, consisted of a compact layer of stones and gravel at a varying depth (15-40 cm). Dilution from the land drainage was confined only to the upper reaches of the sandy stretch.

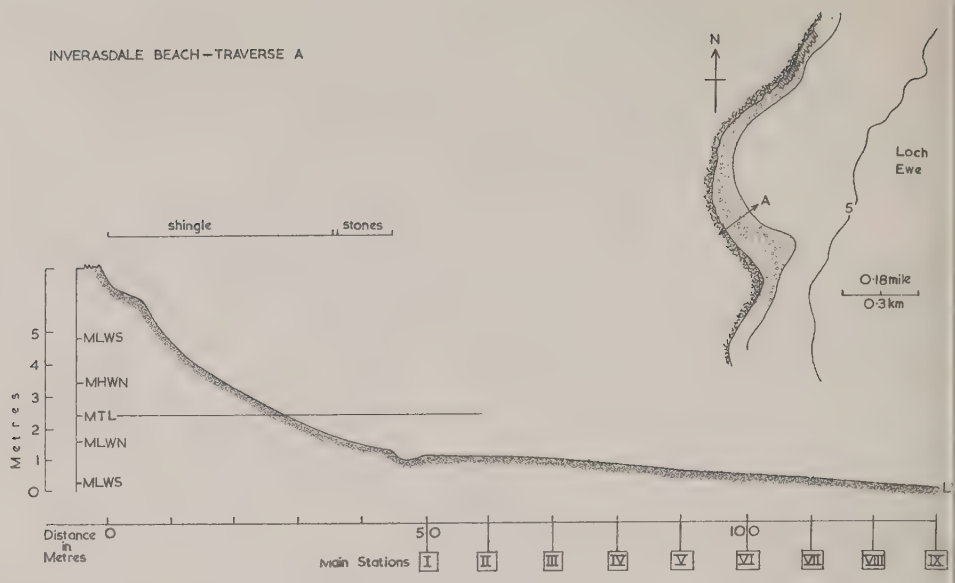

Figure 19. Inverasdale beach profile. Details as in Figure 3.

Fauna. A total of 38 species was recorded on this beach (Table XVIII). Amphipods of the genus *Bathyporeia* were the most numerous organisms and were distributed all over the sand area.

Of the eight species of lamellibranchs only *Tellina tenuis* and *Spisula* were numerous. *T. tenuis* occurred at the upper levels in moderate densities (192-256 m^{-2}). The levels above MLWS tended to have an overall higher biomass, because of a high concentration of heavy *Tellina* specimens at that level. *Spisula,* the most abundant bivalve, was found at all levels below station II, but consisted mainly of juvenile specimens, the upper limit of a larger sublittoral population.

The maximum total density, 2191 m^{-2}, was reached at station IX. The maximum biomass, 3.14 g m^{-2}, obtained at station V below MLWN, reflected the distribution of *Tellina tenuis,* which was present at this level but absent below MLWS.

A general survey of the beach as a whole also revealed populations of *Arenicola, Ensis, Lanice* and *Peachia* in densities between 1 and 3 m^{-2}.

Loch Gilp (Fig. 20)

Physical features. This is a large shallow inlet (< 5 fm) on the north-west side of Loch Fyne, about 23 km north of the mouth of the loch. The intertidal part of the beach is mainly sand, with extensive algae-covered rocky sides. The beach is completely sheltered from much of the prevailing wind and wave action in the main arm of Loch Fyne.

The berm and the upper reaches of the beach are eliminated by a sea wall and so the sandy area is limited to the area below mid tide. Immediately above and below mid tide, banks of badly sorted sediments and shell fragments lie parallel to the shore.

At the upper level one large stream in a permanent bed crossed the beach, its course becoming variable near low water. The water of the stream contained quantities of peat as well as some domestic sewage from the nearby village. The sediments below the banks of the upper beach were less muddy and better sorted (Fig. 2, Table I).

The surface sediments of the beach were in general finer and better sorted than the deeper strata. At most stations there was an important stratification in the sediments, but some showed a uniform well-mixed substratum.

Because of the flat profile and the low tidal level of the area most stations remained water saturated or even covered with surface water, but a few patches of coarser sediments tended to dry out during low water.

The numerous streams contributed towards a moderated dilution, which varied along the points of the traverse.

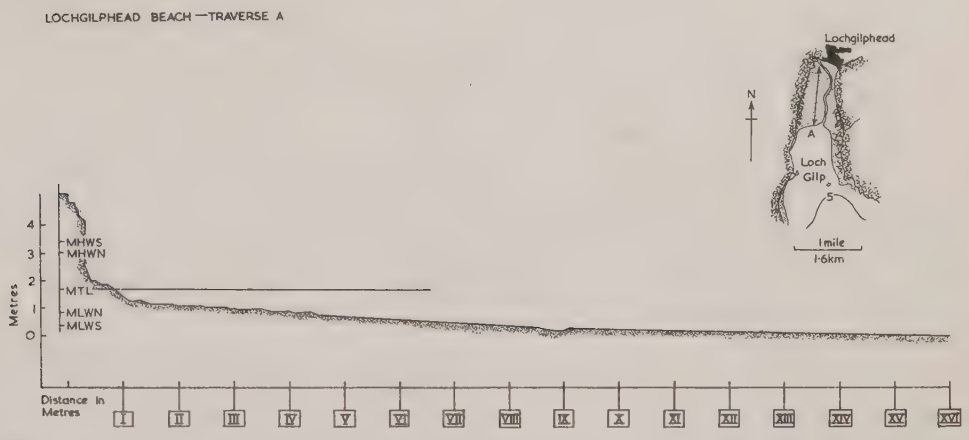

Figure 20. Loch Gilp beach profile. Details as in Figure 3.

Fauna. A total of 37 species (excluding insects) was collected on the main transect (Table XIX) and an additional number was taken elsewhere on the beach. Of these additional species some, such as *Mytilus edulis* and *Venerupis pallastra,* were confined to the beach while others, such as small decapods *(Cancer* and *Crangon)* and mysids, were tidal migrants.

Lowered salinities at sheltered inner areas of the beach favoured the presence of the estuarine organisms such as *Hydrobia ulvae, Macoma, Corophium volutator* and nereids. *Hydrobia,* though found over a large area, was abundant only from mid tide to below MLWN. Nevertheless the fauna was marine in nature, and below MLWN *Macoma* was replaced by *Cerastoderma edule,* which occurred on most of the middle and lower beach. The heart urchin *Echinocardium cordatum* was common at the lower reaches of the beach between MLWS and ELWS but was present in very low densities and it was taken only once in the transect samples.

The numbers of animals obtained per station ranged between 848 and 24288m^{-2}, the highest densities being recorded between approximately mid tide and MLWN. The overall mean biomass on the beach was 42.5 g m^{-2}, but nearly 95% of this consisted of molluscs, the figures being greatly increased by the presence of a mixed population of young and mature cockles *(Cerastoderma)* between MLWN and the low water mark. On some stations concentration of these molluscs was responsible for biomass values as high as 300 g m^{-2}.

Barassie Sands (Fig. 21)

Physical features. Barassie Sands, in Irvine Bay, are only a small part of an extensive sandy beach stretching for several miles north of Troon. The headland of Troon shelters the beach from south westerly winds and wave action.

The beach shows a rugged profile, with runnels and ridges, some containing large quantities of shell fragments and coarse material. The sand contained a large amount of shell fragments especially in the vicinity of MLWN, and only a little organic debris in places. The sand was fine overall and sorting was good, with no evidence of vertical stratification (Fig. 2; Table I).

Seawater retained in the runnels of the upper level was particularly affected by freshwater dilution.

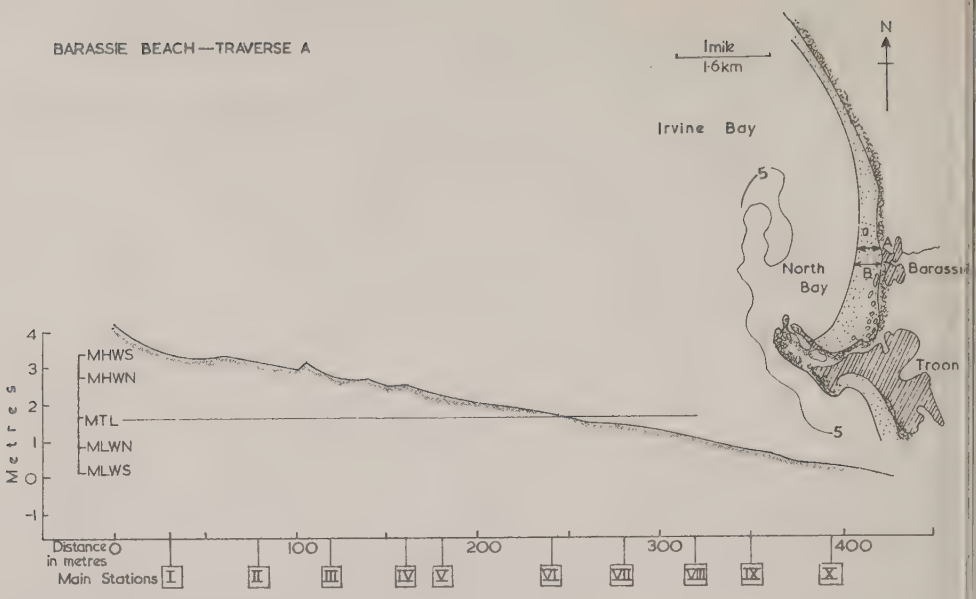

Figure 21. Barassie beach profile. Details as in Figure 3.

Fauna. A total of 34 species (excluding insects) was recorded on the main traverse (Table XX) and the fauna of the secondary traverse was similar, with only slight numerical differences.

Tellina tenuis, the dominant mollusc, was widely distributed from above MHWN to MLWS, owing to the irregularity of the beach relief, which created favourable conditions for the settlement of intertidal animals at levels from which they were normally absent. There was a numerical gradient with densities ranging from 32 m^{-2} at mid tide to a maximum of 3488 m^{-2} at MLWS. A significant proportion of juvenile specimens was present though the majority were adults. Molluscs accounted for over 80% of the overall mean biomass of 20.03 g m^{-2}.

Prestwick (Fig. 22)

Physical features. This beach lies in the middle of an extensive sandy stretch of open coast, receiving some protection from the Isle of Arran and the more distant peninsula of Kintyre. Immediately south of the sampling area a domestic effluent pipe enters the sea below LW mark but onshore winds tend to direct the effluent towards the beach.

The sand contained some shell fragments, and at lower levels quantities of organic matter gave the sand a dark grey colour and an acrid smell. Nevertheless no anaerobic condition was observed. Debris from the domestic effluent was present both on the beach and in the water. The sand was fine overall and there was a pronounced gradient with the finer grades lying at the lower foreshore (Fig. 2; Table I). Vertical stratification of the grades was evident, with the finer grades lying in deeper strata, except between MHWN and mid tide where the finer grades were present on the surface.

Surface water was present on the beach, and a runnel immediately below mid tide level retained a permanent pool which contained water of reduced salinity.

Fauna. A total of 29 species was found during the survey (Table XXI). Of the polychaetes, the widespread presence of capitellids was probably associated with domestic pollution. They occurred all over the beach from MHWN to MLWS, in moderate to high densities, but ever higher densities were recorded on lateral stations near the sewer outfall.

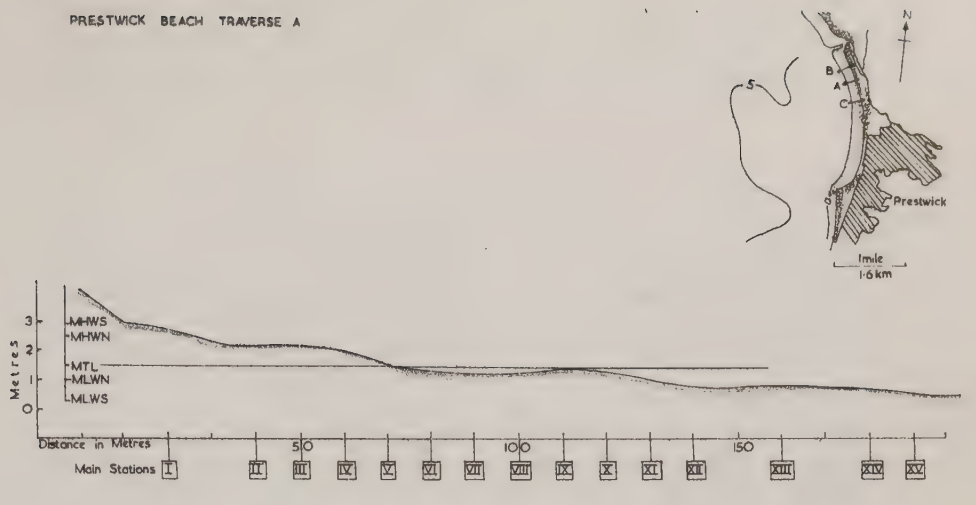

Figure 22. Prestwick beach profile. Details as in Figure 3.

Tellina tenuis, the dominant animal, was widely distributed from above mid tide down to the low water mark, reaching a maximum of 1664 m^{-2} between MLWN and MLWS. Higher densities, however, were present at the low water stations of the secondary traverses, reaching 1920 m^{-2} south of the main traverse and 2176 m^{-2} north of the main traverse. The population contained both juveniles and adults. Though *Donax* was as common on the beach, as *Tellina,* it was not as abundant as the latter. The secondary traverses again included higher densities of *Donax*, reaching a maximum of 176 m^{-2} south of the main traverse and 224 m^{-2} north of the main traverse. High biomass in certain stations (> 63 g m^{-2}) was due mostly to the presence of molluscs, which made up 80% of the mean biomass of 15.5 g m^{-2}.

Sandhead (Fig. 23)

Physical features. Luce Bay, a large shallow bay open to the Irish Sea, is affected by westerly winds and swell, but the western reaches are comparatively sheltered by the Mull of Galloway and shelter increases from east to west. Only the westernmost part of the extensive beach at Sandhead was examined and sampled. Small streams enter at various points and there are drain outlets at intervals along the beach discharging freshwater and some organic waste. The upper foreshore is composed of stones and coarse gravel, becoming sandy below MHWN. A runnel containing stones covered with algae *(Enteromorpha)* and carrying freshwater and organic debris crosses the beach at MHWN to form a definite channel towards the lower foreshore.

The sand below MHWN was fine and well sorted (Fig. 2; Table I). There was a small gradient in the horizontal arrangement of the grades, and except in Station I, where finer grades were found in deeper strata, there was no stratification.

Salinities indicate that the influence of the fresh water in the runnel at MHWN extends to the lower levels, where salinities as low as 15.6‰ were recorded.

Fauna. A total of 32 species (excluding insects) was obtained on the surveyed part of the beach between MHWN and MLWS (Table XXII). The fauna of the coarse sediments, above MHWN, was not investigated.

There was a predominance of polychaete species such as *Nerine, Pygospio, Eteone* and *Ophelia,* which were confined to the well-drained ridge between mid tide and MLWN, while *Nephtys cirrosa* and *N.hombergi* were widely distributed from almost MHWN to below MLWS.

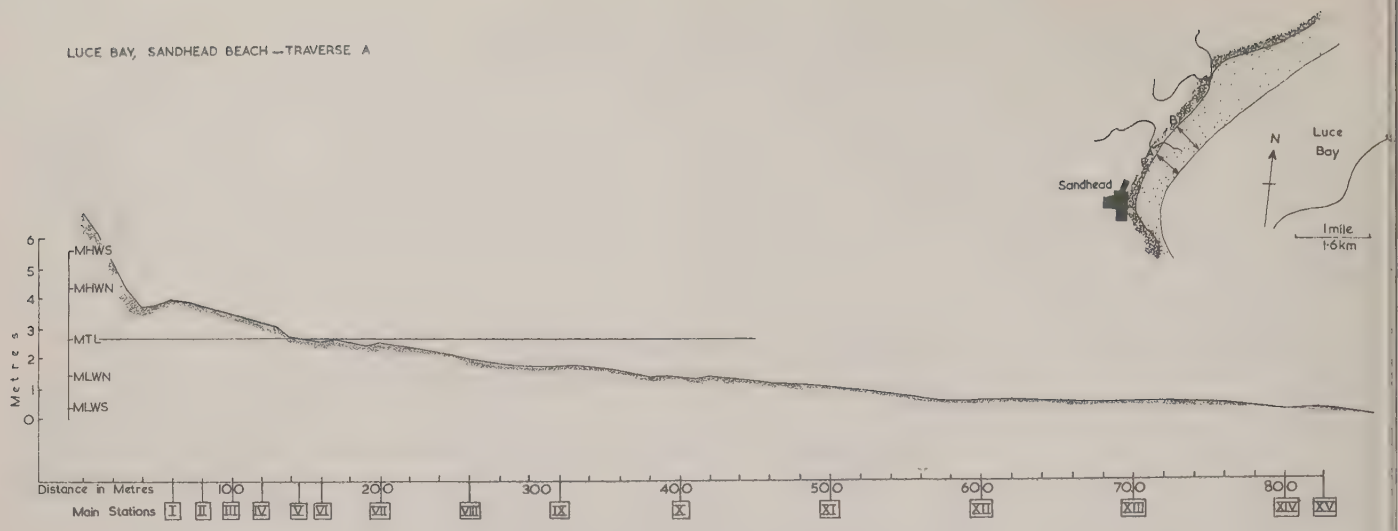

Figure 23. Sandhead beach profile. Details as in Figure 3.

Crustaceans were poorly represented and only *Bathyporeia pilosa* was present at many levels in moderate densities.

Tellina tenuis was the most important mollusc, occurring in large densities and widely distributed. A small percentage of 1+ animals was present in the population. Below MLWS it was replaced by *Tellina fabula,* but at low density.

The numbers of the animals on the beach varied from 1936 m^{-2} (about MHWN) to 320 m^{-2} about mid tide. A definite reduction in numbers and species at the lower levels of the beach suggests the adverse effect of reduced salinities and perhaps turbulence and instability operating at this level. In stations where molluscs, particularly *Cerastoderma*, were abundant, biomass of the order of 26 g m^{-2} was obtained.

Discussion - Sheltered Beaches

While sandy beaches are not found in completely sheltered situations, the eight beaches described in this section are substantially protected from direct wave action or swell because of their aspect or location. The sand on these beaches is well sorted, and although it is often similar to that found in moderately exposed areas, the median diameter drops in places to as low as 105 μm, and is often in the range 130-150 μm.

A considerably greater variety of species is found on the sheltered beaches, and many species are abundant here which, though present, were poorly represented in the more exposed areas. Crustaceans are no longer dominant, but all the previously recorded species are again present, sometimes in big numbers, with the addition of *Corophium* and several species of cumaceans, particularly *Bodotria scorpioides* and *Pseudocuma longicornis.* Polychaetes are now considerably more abundant and are often the dominant group numerically. However, the most important change in the sheltered areas is that molluscs are now the dominant forms by weight and occasionally also by number. Altogether 18 Mollusc species (15 lamellibranchs and 3 gastropods) were recorded on main transects, and of these *Tellina tenuis* was clearly the most abundant lamellibranch, reaching a maximum of nearly 3500 m^{-2}.

The further increase in fauna at levels above mid-tide was noted, with oligochaetes, *Eurydice* and *B. pilosa* being joined by such polychaetes as *Fabricia, Spio, Pygospio, Aricidea* and capitellids, while the gastropod *Hydrobia* was numerous at high levels on the most sheltered areas such as Loch Gilp.

Again, however, the bulk of the populations was distributed below the mid tide level, and here the total number of individuals ranged from 272 to 24,288 m^{-2} and dry weights from 0.55 to 63.14 m^{-2} with a mean of 9.77 g m^{-2}. Where important concentrations of *Cerastoderma* and *Donax* were present, the biomass was considerably higher, increasing the mean value to 21.9 g m^{-2}.

Conclusions

The study of a number of sandy beaches covering a range of environmental conditions revealed faunistic variation which reflected the different species' tolerance of or preference for the conditons prevailing on particular beaches. Whenever a balanced situation in the environmental conditions existed, especially between shelter and exposure, a typical marine north-temperate water community characterised by the bivalve *Tellina tenuis* was present. This community included a basic faunistic complement consisting of polychaetes (both sessile and errant, such as *Nerine cirratulus* and *Ophelia rathkei* in the middle beach and *Paraonis fulgens, Arenicola marina, Spio filicornis, Scoloplos armiger, Nephtys cirrosa* and *N. hombergi* at the lower levels and a few crustaceans *(Talitrus saltator, Haustorius arenarius, Bathyporeia pilosa,* and *Eurydice pulchra* on the upper beach and *Bathyporeia pelagica, B. elegans, Pontocrates norvegicus* and *P. arenarius* on the lower foreshore). (Table XXIII).

With a few exceptions their intertidal distribution conformed to a well documented pattern which was expressed by Stephen (1930) as " ... the order of distribution and maximum density of respective species, passing from high water to low water mark has always been found to be the same, pointing to the intertidal fauna being distributed in a well-established order".

The above species were not only common but also numerically dominant and made up a large proportion of the biomass. This fauna, consisting predominantly of intertidal species and including both swimming and sessile forms in balanced proportions, was taken as basic, though variations did occur, particularly in the extremes of the exposure spectrum. Severe exposure restricts diversity, eliminating sedentary forms, especially bivalve molluscs and, encouraging the numerical dominance of agile swimmers such as haustoriid amphipods and isopods. These species have a short life span and the fauna is characterised by its flexibility. Extreme shelter favours the establishment of a predominantly sessile community of polychaetes and long-living bivalves, restricting or eliminating swimming forms of amphipods and isopods and at the same time encouraging the colonisation of the intertidal area by subtidal species such as *Tellina fabula, Lucinoma borealis, Perioculodes longimanus, Chaetozone setosa, Owenia fusiformis, Exogone hebes* etc. In extreme cases of freshwater dilution at the inner and upper levels of certain beaches, such estuarine species as *Corophium volutator, Hydrobia ulvae, Nereis diversicolor* and *Macoma balthica* often become permanently established. In addition a number of tidal migrants such as amphipods, mysids, and decapods or drifting species associated with algal growths *(Melita obtusata, Dexamine spinosa, Stenothoe marina, Idotea* spp. etc) might be stranded on the beach, thus contributing to the faunistic variation.

Although the effect of one or more environmental factors acting singly or in conjunction with others can be important, there is evidence that the paramount factor controlling the whole beach system is exposure. Exposure to different degrees of hydrodynamism (wave action) will directly determine the angle and the profile of the beach, the texture and the sorting of the sediment, porosity, permeability and the associated factors in the sediment (drainage, pH, oxygen availability, organic content etc.), which in their turn will determine the composition and the density of the intertidal infauna.

Several authors have attempted to express the relative meaning of exposure to wave action by devising arbitrary exposure scales (Southward, 1953; Colman and Segrove, 1955; Lagardère, 1966) based on one or more physical-chemical environmental characteristics whose effect on the fauna was not always clear. Eleftheriou and Nicholson (1975), using the sediment characteristics of the different beaches described in the present study in conjunction with their faunistic indices (diversity, density and biomass), showed the possibility of discriminating between beaches of different exposure. However, it was possible to distinguish only two groups of beaches which separated by a mean particle diameter of 232 μm could be defined as exposed and sheltered, the latter including the semi-exposed group. It also became obvious that the sediment characteristics alone were not sufficient to characterise a beach as to its degree of exposure. However, as was pointed out by Eleftheriou and Nicholson, this did not constitute a classification system but merely a categorisation of beaches into broadly defined groups.

By providing additional information on the physical environment (beach slope, position of beach in relation to prevailing winds, fetch etc.) of beaches, always in relation to their biological characteristics, the categorisation of beaches into better defined groups could be improved. Given the faunistic characteristics of any other beach it should be possible to assess its degree of exposure by comparing it with the characteristics of the beaches described here.

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Table I. Physico-chemical characteristics of beaches

Station number	Distance (m) from fixed point	Tidal level	Sediment: Median Diameter Md (μm)	Sediment: Sorting Coefficient So	Salinity ‰	Temperature °C
Dunnet 7.4.67						
I	32	∿MHWS	200	1.08	-	17.9
II	82	MHWN	220	1.14	31.6	16.0
III	132	∿MTL	230	1.11	30.8	15.1
IV	193	MLWN	235	1.08	32.0	13.8
V	235	MLWS	250	1.20	34.1	13.9
Sandside 9.4.67						
I	67	∿MHWS	580	1.41	-	18.5
II	85	MTL	420	1.29	27.0	15.7
III	138	MLWN	410	1.23	29.5	15.6
IV	216	-	290	1.25	30.0	14.2
V	254	MLWS	280	1.27	33.2	14.0
Strathy 8.4.67						
I	43	∿MHWS	390	1.31	-	18.0
II	60	∿MHWN	360	1.33	28.1	17.3
III	77	MTL	370	1.49	30.5	15.1
IV	215	∿MLWN	350	1.29	31.8	14.2
V	326	MLWS	390	1.26	34.3	13.8
Traigh Iar 8.4.70						
I	15	∿MHWS	260	1.42	34.7	6.8
II	50	∿MHWN	-	-	-	7.3
III	75	MTL	-	-	-	7.0
IV	100	∿MLWN	232	1.47	27.4	7.2
V	160	-	-	-	-	6.8
VI	220	MLWS	197	1.35	34.3	6.7
Traigh Eais 3.4.69						
I	35	MHWS	325	1.40	-	7.0
II	55	MHWN	-	-	34.8	-
III	75	MTL	-	-	34.4	7.6
IV	95	-	-	-	-	-
V	115	MLWN	-	-	26.7	7.6
VI	135	-	260	1.26	-	-
VII	155	-	-	-	32.3	7.9
VIII	175	-	-	-	-	-
IX	195	MLWS	-	-	34.7	-
X	205	-	280	1.33	-	8.0
Mellon Charles 26.2.67						
I	5	MHWS	220	1.16	-	8.1
II	10	-	-	-	-	-
III	20	MHWN	200	1.23	28.2	7.9
IV	30	∿MTL	-	-	21.7	-
V	40	-	200	1.22	-	7.7
VI	50	MLWN	-	-	27.1	-
VII	60	-	210	1.41	-	7.5
VIII	75	-	-	-	27.3	-
IX	90	∿MLWS	200	1.34	-	7.3
X	100	-	185	1.30	31.5	6.9

Table I. Physico-chemical characteristics of beaches *(continued)*

Station number	Distance (m) from fixed point	Tidal level	Sediment		Salinity ‰	Temperature °C
			Median Diameter Md (μm)	Sorting Coefficient So		
Firemore South 10.3.65						
I	20	MHWS	-	-	-	-
II	40	-	220	1.17	28.5	6.9
III	60	∿MHWN	-	-	-	-
IV	80	∿MTL	220	1.23	23.1	6.9
V	100	-	220	1.23	27.8	7.3
VI	120	-	220	1.23	28.8	7.1
VII	140	-	210	1.20	32.6	8.1
VIII	160	-	220	1.21	33.8	8.2
IX	180	MLWN	-	-	32.8	9.0
X	200	-	-	-	-	-
XI	220	-	250	1.30	34.3	8.0
XII	240	∿MLWS	-	-	-	-
XIII	260	-	260	1.37	33.6	7.9
XIV	280	-	255	1.43	30.5	8.0
XV	300	-	-	-	-	-
Firemore North 15.3.65						
I	35	-	-	-	-	-
II	55	∿MHWS	205	1.15	29.0	6.9
III	75	∿MHWN	205	1.15	28.6	6.8
IV	95	MTL	210	1.22	26.3	7.2
V	115	∿MLWN	205	1.20	26.6	7.1
VI	125	-	210	1.12	30.2	7.5
VII	135	-	210	1.12	27.9	7.6
VIII	155	∿MLWS	210	1.12	33.9	7.3
Big Sand 12.5.68						
I	30	MHWS	250	1.21	11.5	8.5
II	60	∿MHWN	-	-	30.1	12.8
III	90	∿MTL	290	1.43	28.3	11.4
IV	120	∿MLWN	250	1.49	-	11.8
V	135	-	-	-	32.1	-
VI	150	-	-	-	-	-
VII	165	MLWS	200	1.16	34.2	10.5
Turnberry 12.6.68						
I	28	MHWS	260	1.44	-	-
II	40	∿MHWN	1660	1.64	25.8	-
III	50	-	195	1.12	24.8	16.2
IV	60	MTL	-	-	-	-
V	70	-	-	-	-	-
VI	80	MLWN	205	1.27	30.1	14.2
VII	90	-	-	-	-	-
VIII	100	-	-	-	-	-
IX	110	-	-	-	-	-
X	120	-	-	-	-	-
XI	125	MLWS	185	1.17	35.6	13.0
Lendalfoot 14.6.68						
I	10	MHWS	-	-	25.4	19.8
II	40	-	-	-	29.7	18.7
III	60	-	-	-	-	-
IV	80	∿MTL	155	1.15	-	-
V	100	MLWN	155	1.13	-	-
VI	120	-	250	2.98	33.5	18.4
VII	140	MLWS	140	1.10	-	-

Table I. Physico-chemical characteristics of beaches *(continued)*

Station number	Distance (m) from fixed point	Tidal level	Sediment		Salinity ‰	Temperature °C
			Median Diameter Md (μm)	Sorting Coefficient So		
Port Logan 10.6.68						
I	15	MHWS	175	1.05	12.6	15.2
II	25	-	-	-	-	-
III	40	-	-	-	-	-
IV	55	MHWN	-	-	-	-
V	80	-	180	1.08	33.3	13.9
VI	100	∿MTL	-	-	-	-
VII	120	∿MLWN	-	-	-	-
VIII	135	-	-	-	-	-
IX	140	-	175	1.10	-	12.7
X	145	∿MLWS	-	-	29.8	-
Traigh Mhor 1.4.69						
I	(i) 20	∿MHWN	1200	3.50	-	7.6
II	50	-	-	-	-	-
III	200	-	-	-	-	7.8
IV	400	MTL	-	-	-	-
V	500	-	-	-	-	-
VI	600	-	210	1.25	36.1	7.8
VII	(ii) 100	MLWN	-	-	-	-
VIII	200	-	-	-	35.5	7.8
IX	300	-	-	-	-	-
X	400	-	-	-	35.1	7.8
XI	500	-	315	1.45	-	8.0
XII	600	-	-	-	35.4	-
XIII	700	-	-	-	-	-
XIV	800	-	-	-	35.7	-
XV	900	MLWS	-	-	-	-
XVI	1000	-	280	1.25	35.7	8.1
XVII	1100	-	-	-	-	-
XVIII	1150	-	-	-	-	8.0
Gruinard 14.10.66						
I	20	∿MHWN	240	1.34	-	11.7
II	40	-	-	-	29.6	11.5
III	70	-	210	1.15	27.4	11.6
IV	100	MTL	-	-	-	-
V	130	-	230	1.20	27.3	11.9
VI	160	MLWN	-	-	-	-
VII	190	-	180	1.21	32.7	12.2
VIII	220	-	-	-	-	-
IX	260	-	245	1.17	23.0	11.8
X	300	-	-	-	-	-
XI	340	-	225	1.20	34.0	12.3
XII	380	-	-	-	-	-
XIII	420	-	220	1.15	34.3	12.8
XIV	460	-	-	-	-	-
XV	500	-	220	1.17	23.8	12.4
XVI	540	MLWS	-	-	-	-
XVII	590	-	180	1.17	35.4	12.3
Aultbea 15.5.68						
I	90	MLWN	290	1.95	29.4	14.2
II	120	-	-	-	11.0	-
III	150	-	-	-	28.5	14.7
IV	180	-	-	-	30.0	-
V	210	-	160	1.14	26.3	13.6
VI	240	MLWS	-	-	32.8	-
VII	280	-	210	1.22	29.3	13.8

Table I. Physico-chemical characteristics of beaches *(continued)*

Station number	Distance (m) from fixed point	Tidal level	Sediment		Salinity ‰	Temperature °C
			Median Diameter Md (μm)	Sorting Coefficient So		
Inverasdale 17.9.66						
I	50	-	-	-	32.9	-
II	60	∿MLWN	220	1.20	-	13.7
III	70	-	-	-	-	-
IV	80	-	-	-	-	-
V	90	-	190	1.11	33.0	13.5
VI	100	-	-	-	-	-
VII	110	-	-	-	-	-
VIII	120	∿MLWS	-	-	34.4	13.5
IX	130	-	140	1.11	-	-
Gairloch 15.10.66						
I	25	MHWS	310	1.23	33.5	11.6
II	40	MHWN	-	-	-	-
III	55	-	310	1.24	22.7	12.2
IV	70	-	-	-	-	-
V	85	MTL	350	1.26	24.9	12.6
VI	100	MLWN	-	-	-	-
VII	120	-	270	1.19	34.6	11.8
VIII	140	-	-	-	-	-
IX	160	-	240	1.19	34.3	11.4
X	180	MLWS	-	-	-	-
XI	185	-	240	1.22	34.3	11.2
Loch Gilp 17.3.69						
I	100	∿MTL	105	1.22	32.7	4.0
II	300	-	-	-	30.2	3.0
III	400	-	-	-	-	-
IV	600	∿MLWN	180	1.34	32.2	3.5
V	800	-	-	-	-	-
VI	900	-	170	1.20	32.8	4.2
VII	1000	-	-	-	-	-
VIII	1100	MLWS	210	1.20	35.1	5.0
IX	1200	-	-	-	-	-
X	1300	-	-	-	33.0	4.6
XI	1400	-	-	-	-	-
XII	1500	-	180	1.18	32.2	5.5
XIII	1600	-	-	-	-	-
Barassie 15.6.68						
I	30	MHWS	-	-	19.7	20.4
II	80	-	155	1.18	-	-
III	120	MHWN	-	-	-	-
IV	160	-	-	-	-	-
V	180	-	150	1.08	33.0	18.7
VI	240	MTL	-	-	-	-
VII	280	-	-	-	-	-
VIII	320	MLWN	-	-	-	-
IX	350	-	-	-	-	-
X	392	∿MLWS	140	1.09	33.4	18.0

Table I. Physico-chemical characteristics of beaches *(continued)*

Station number	Distance (m) from fixed point	Tidal level	Sediment		Salinity ‰	Temperature °C
			Median Diameter Md (μm)	Sorting Coefficient So		
Prestwick 13.6.68						
I	20	MHWS	235	1.43	33.0	19.5
II	40	∿MHWN	-	-	-	-
III	50	-	200	1.24	-	-
IV	60	-	-	-	-	-
V	70	MTL	165	1.18	29.5	18.4
VI	80	-	-	-	-	-
VII	90	-	-	-	-	-
VIII	100	-	-	-	-	-
IX	110	-	-	-	-	-
X	120	-	-	-	-	-
XI	130	MLWN	150	1.06	-	17.0
XII	140	-	-	-	-	-
XIII	160	-	-	-	-	-
XIV	180	-	-	-	-	-
XV	190	∿MLWS	145	1.09	31.6	16.5
Sandhead 11.6.68						
I	60	∿MHWN	195	1.13	34.4	17.3
II	80	-	-	-	-	-
III	100	-	-	-	34.7	17.0
IV	120	-	-	-	-	-
V	145	MTL	145	1.14	15.6	16.3
VI	160	-	-	-	-	-
VII	200	-	-	-	-	-
VIII	260	-	145	1.10	-	14.5
IX	320	-	-	-	-	-
X	400	MLWN	-	-	-	15.8
XI	500	-	-	-	-	-
XII	600	-	140	1.07	21.4	14.1
XIII	700	-	-	-	-	-
XIV	800	MLWS	-	-	-	-
XV	825	-	135	1.03	32.7	13.2

Table II. Dunnet. Main traverse

A. Numbers of animals (per $^1/_{16}m^2$)

Species	Stations I ~MHWS	II MHWN	III ~MTL	IV MLWN	V MLWS
Talitrus saltator	35	-	-	-	-
Haustorius arenarius	-	-	1	4	4
Bathyporeia pilosa	-	1	-	2	-
Pontocrates norvegicus	-	-	-	-	41
Eurydice pulchra	-	-	2	-	5
Nerine cirratulus	-	26	10	2	1
Paraonis fulgens	-	2	5	23	1
Eteone sp.	-	-	1	-	-
Capitellidae	-	-	1	-	-
Nemertea	-	2	2	1	-
Insecta (larvae)	3	-	-	-	-
Total	38	31	22	32	52

B. Biomass (g dry weight m^{-2})

Group	Stations I	II	III	IV	V	Mean	%
Crustacea	1.710	0.001	0.044	0.098	0.175	0.405	34.6
Polychaeta	-	2.349	0.949	0.332	0.049	0.735	62.8
Others	0.036	0.048	0.048	0.025	-	0.031	2.6
Total	1.746	2.398	1.041	0.455	0.224	1.171	

Table III. Sandside. Main traverse

A. Numbers of animals (per $^1/_{16}m^2$)

Species	Stations I ~MHWS	II MTL	III MLWN	IV -	V MLWS
Talitrus saltator	-	-	-	1	-
Bathyporeia pilosa	-	-	-	1	1
B. pelagica	-	1	-	2	1
B. guilliamsoniana	-	-	-	1	-
Pontocrates norvegicus	-	14	14	12	1
Calliopius laeviusculus	-	-	1	-	-
Eurydice pulchra	-	20	3	-	2
Idotea sp.	-	-	1	-	-
Nerine cirratulus	-	1	-	3	-
Paraonis fulgens	-	-	5	8	14
Nephtys cirrosa	-	-	1	-	-
Capitellidae	-	-	-	-	1
Ophelia rathkei	-	1	2	-	1
Archiannelida	-	-	21	8	-
Oligochaeta	-	1	-	-	1
Nemertea	-	-	1	1	-
Total	-	38	49	37	22

B. Biomass (g dry weight m^{-2})

Group	Stations I	II	III	IV	V	Mean	%
Crustacea	-	0.375	0.038	0.013	0.029	0.091	45.5
Polychaeta	-	0.004	0.045	0.097	0.269	0.083	41.5
Others	-	0.003	0.098	0.028	0.001	0.026	13.0
Total	-	0.382	0.181	0.138	0.299	0.200	
Large individuals:							
Nephtys	-	-	5.363	-	-	1.072	
Grand Total	-	0.382	5.544	0.138	0.299	1.272	

Table IV. Strathy. Main traverse

A. Number of animals (per $^{1}/_{16}m^{2}$)

Species	Stations I ~MHWS	II ~MHWN	III MTL	IV ~MLWN	V MLWS
Pontocrates norvegicus	1	-	2	12	-
Bathporeia pilosa	-	-	5	-	-
Eurydice pulchra	-	3	20	4	2
Nerine cirratulus	-	-	1	1	3
Ophelia rathkei	-	-	-	1	-
Paraonis fulgens	-	-	-	2	-
Nephtys cirrosa	-	-	-	1	-
Tellina tenuis	-	-	-	-	1
Ammodytes lanceolatus	-	-	-	-	1
Total	1	3	28	21	7

B. Biomass (g dry weight m^{-2})

Group	Stations I	II	III	IV	V	Mean	%
Crustacea	⟨0.001	0.038	0.013	0.093	0.081	0.045	11.9
Polychaeta	-	-	0.349	0.431	0.051	0.166	43.9
Mollusca	-	-	-	-	0.835	0.167	44.2
Total	⟨0.001	0.038	0.362	0.524	0.967	0.378	

Table V Traigh Iar. Main traverse

A. Numbers of animals (per $^{1}/_{16}m^{2}$)

Species	Stations I ~MHWS	II ~MHWN	III MTL	IV ~MLWN	V -	VI MLWS
Bathyporeia pelagica	-	-	-	3	2	4
Pontocrates norvegicus	-	-	-	-	5	7
Eurydice pulchra	-	-	1	2	2	-
Nerine cirratulus	-	-	-	1	-	-
Spio filicornis	-	-	-	1	-	-
Paraonis fulgens	-	-	-	1	2	3
Ophelia rathkei	1	-	-	-	-	-
Nephtys cirrosa	-	-	-	1	1	1
Phyllodoce sp.	-	-	-	1	-	-
Eteone sp.	-	-	-	-	1	-
Oligochaeta	20	4	1	-	-	-
Nemertea	-	1	2	1	-	1
Total	21	5	4	11	13	16

B. Biomass (g dry weight m^{-2})

Groups	Stations I	II	III	IV	V	VI	Mean	%
Crustacea	-	-	0.008	0.027	0.029	0.043	0.018	18.0
Polychaeta	0.024	-	-	0.174	0.102	0.046	0.057	57.0
Others	0.075	0.020	0.030	0.025	-	+	0.025	25.0
Total	0.099	0.020	0.038	0.226	0.131	0.089	0.100	

Table VI Traigh Eais. Main traverse

A. Numbers of animals (per $^{1}/_{16}m^{2}$)

Species	Stations I	II	III	IV	V	VI	VII	VIII	IX	X
	MHWS	MHWN	MTL	-	MLWN	-	-	-	MLWS	-
Talitrus saltator	1	-	-	-	-	-	-	-	-	-
Pontocrates norvegicus	-	-	10	5	5	12	13	10	3	7
Bathyporeia pelagica	-	-	81	98	31	131	15	28	11	11
Eurydice pulchra	-	-	3	5	1	8	1	-	-	-
Pseudocuma longicornis	-	2	-	-	-	-	-	-	-	-
Lamprops fasciata	-	-	-	1	-	-	-	-	-	-
Nerine cirratulus	-	-	-	-	-	-	1	-	-	-
Pygospio elegans	-	-	3	-	-	-	-	-	-	-
Capitellidae	1	-	-	-	-	-	-	-	-	-
Aricidea sp.	2	-	-	-	-	-	-	-	-	-
Eteone longa	-	-	1	-	-	-	-	-	-	-
Nephtys hombergi	1	-	-	-	-	-	-	-	-	-
N. cirrosa	-	1	-	-	-	-	-	-	-	-
Syllidae	-	-	1	-	-	-	-	-	-	-
Oligochaeta	1	-	4	-	-	-	-	-	-	-
Total	6	3	103	109	37	151	30	38	14	18

B. Biomass (g dry weight m^{-2})

Groups	Stations I	II	III	IV	V	VI	VII	VIII	IX	X	Mean	%
Crustacea	0.199	0.001	0.538	0.661	0.272	1.416	0.890	0.203	0.079	0.074	0.433	95.6
Polychaeta	0.015	0.010	0.158	-	0.002	-	0.017	-	-	-	0.020	4.4
Others	+	-	0.002	-	-	-	-	-	-	-	+	-
Total	0.214	0.011	0.698	0.661	0.274	1.416	0.907	0.203	0.079	0.074	0.453	-

Table VII Mellon Charles. Main traverse

A. Numbers of animals (per $^{1}/_{16}m^{2}$)

Species	Stations I	II	III	IV	V	VI	VII	VIII	IX	X
	MHWS	-	MHWN	~MTL	-	MLWN	-	-	~MLWS	-
Tellina tenuis	-	-	-	-	-	-	-	1	5	19
Venus striatula	-	-	-	-	-	-	-	-	1	1
Mytilus edulis	-	-	-	-	-	1	-	-	-	-
Eurydice pulchra	-	-	-	-	4	-	-	-	-	-
Bathyporeia pilosa	-	1	3	73	24	3	1	-	1	-
B. elegans	-	1	-	-	-	-	-	-	1	-
B. pelagica	-	-	-	-	-	-	1	2	1	-
Atylus swammerdami	-	-	-	-	-	-	-	1	-	-
Pseudocuma longicornis	-	-	-	-	1	-	3	-	1	-
Spio filicornis	-	-	-	-	-	-	-	-	-	1
Nerine cirratulus	-	-	-	2	4	32	74	2	-	-
Spionidae (unident.)	-	-	-	-	-	-	1	-	-	-
Paraonis fulgens	-	-	-	-	-	-	-	-	2	-
Chaetozone setosa	-	-	-	-	-	-	-	-	-	1
Magelona papillicornis	-	-	-	-	-	-	-	-	-	3
Arenicola marina	-	-	-	-	-	-	-	-	1	-
Phyllodoce sp.	-	-	-	-	-	-	-	-	-	1
Eteone sp.	-	-	-	-	-	-	-	1	-	4
Nephtys cirrosa	1	-	-	-	-	-	-	-	-	1
Capitellidae	-	-	-	-	-	1	-	4	3	2
Oligochaeta	9	28	162	12	1	-	-	2	1	-
Insecta (larvae)	3	-	-	-	-	-	-	-	-	-
Total	13	30	165	87	34	37	80	13	17	33

B. Biomass (g dry weight m^{-2})

Groups	Stations I	II	II	IV	V	VI	VII	VIII	IX	X	Mean	%
Crustacea	-	0.002	0.008	0.316	0.170	0.006	0.006	0.014	0.006	-	0.053	3.6
Polychaeta	0.005	-	-	0.076	0.071	3.716	3.189	0.076	1.244	0.220	0.860	60.8
Mollusca	-	-	-	-	-	0.003	-	0.053	1.276	3.012	0.434	30.7
Others	0.010	0.058	0.573	0.033	-	-	-	0.002	0.002	-	0.068	4.7
Total	0.015	0.060	0.581	0.425	0.241	3.725	3.195	0.145	2.528	3.232	1.415	-

Table VIII Firemore Bay South. Main traverse

A. Numbers of animals (per $^{1}/_{16}m^{2}$)

Species	Stations II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV
	~MHWN		~MTL					MLWN			~MLWS			
Tellina tenuis	-	-	-	-	-	1	1	3	1	3	5	7	4	1
Lacuna vincta	-	-	-	1	-	-	-	-	-	-	-	-	-	-
Talitrus saltator	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Bathyporeia pilosa	-	2	10	-	-	-	-	-	-	-	-	-	-	-
B. pelagica	-	-	-	-	-	2	4	5	6	12	18	12	18	7
B. elegans	-	-	-	-	-	-	-	-	-	-	1	-	-	-
Eurydice pulchra	-	33	-	-	19	2	-	-	-		-	-	-	2
Nerine cirratulus	-	2	11	17	47	9	9	10	3	1	2	1	2	3
Ophelia rathkei	-	-	1	27	65	88	4	-	1	1	-	1	-	2
Paraonis fulgens	-	-	-	3	-	-	-	1	1	2	2	2	4	-
Spio filicornis	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Scolelepis fuliginosa	-	-	-	1	-	-	-	-	-	-	-	-	-	-
Capitellidae	-	-	-	1	-	-	-	-	-	-	-	-	-	-
Psammodrilus balanoglossoides	-	-	-	-	-	-	1	1	3	1	-	-	-	-
Nephtys cirrosa	-	-	-	-	-	-	1	1	-	2	2	2	3	3
Nemertea	-	-	-	1	1	2	3	1	-	3	-	-	3	-
Oligocheata	2	-	-	-	-	-	-	-	-	-	-	-	-	-
Insecta (larvae)	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	3	38	22	51	132	104	23	22	15	25	30	25	34	19

B. Biomass (g dry weight m^{-2})

Groups	Stations III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	Mean	%
Crustacea	0.214	0.010	-	0.151	0.013	0.006	0.006	0.145	0.022	0.025	0.013	0.016	0.009	0.049	4.5
Polychaeta	0.048	0.659	2.152	3.941	0.570	0.426	0.205	0.014	0.069	0.069	0.152	0.312	0.731	0.719	68.0
Mollusca	-	-	0.012	-	0.232	0.067	0.411	0.150	0.274	0.825	1.088	0.533	0.093	0.283	27.0
Others	-	-	0.002	0.001	0.001	0.024	0.009	-	0.018	-	-	0.059	-	0.009	0.5
Total	0.262	0.669	2.166	4.093	0.816	0.523	0.631	0.309	0.383	0.919	1.253	0.920	0.833	1.060	

Table IX. Firemore Bay North. Main traverse

A. Numbers of animals (per $^1/_{16}m^2$

Species	Stations II ~MHWS	III ~MHWN	IV MTL	V ~MLWN	VI -	VII -	VIII ~MLWS
Tellina tenuis	-	-	-	1	14	19	30
Venus striatula	-	-	-	-	-	-	1
Atylus swammerdami	7	-	2	22	11	7	8
Bathyporeia pilosa	2	1	4	-	-	-	-
B. pelagica	-	-	1	7	1	-	-
B. elegans	-	-	-	-	-	-	1
Siphonoecetes dellavallei	-	-	-	-	1	-	4
Gammarus locusta	-	-	-	7	-	-	-
Melita obtusata	-	-	-	-	-	3	-
Stenothoe marina	-	-	-	-	-	1	-
Pontocrates arenarius	-	-	-	-	-	24	21
Cressa dubia	-	-	-	-	-	-	1
Synchelidium haplocheles	-	-	-	1	-	-	-
Eurydice pulchra	3	31	4	5	5	1	-
Idotea sp. (juv.)	-	-	-	3	1	-	1
Pseudocuma longicornis	-	-	-	-	-	1	-
Nerine cirratulus	-	-	2	13	4	8	-
Spio filicornis	-	-	-	-	2	-	8
Paraonis fulgens	-	-	-	-	1	3	1
Ophelia rathkei	-	-	-	1	-	-	-
Poecilochaetus serpens	-	-	-	-	1	-	-
Orbinia sp.	-	-	-	-	-	1	-
Psammodrilus balanoglossoides	-	-	-	-	-	-	4
Nephtys cirrosa	-	-	-	-	1	2	6
Phyllodoce maculata	-	-	-	1	-	-	-
Syllis sp.	-	-	-	1	-	-	-
Echinocardium cordatum	-	-	-	-	-	-	1
Oligochaeta	15	2	-	-	-	-	-
Nemertea	-	-	-	-	1	-	1
Total	27	34	13	62	43	70	88

B. Biomass (g dry weight m^{-2})

Groups	Stations II	III	IV	V	VI	VII	VIII	Mean	%
Crustacea	0.006	0.269	0.059	0.058	0.071	0.020	0.058	0.077	2.7
Polychaeta	-	-	0.087	0.151	0.097	0.304	0.897	0.219	10.7
Mollusca	-	-	-	0.077	2.446	4.697	6.691	1.988	74.1
Others	0.013	0.006	-	-	0.001	-	0.001	0.003	12.5
Total	0.019	0.275	0.146	0.286	2.615	5.021	7.647	2.287	
Large individuals:									
Orbinia	-	-	-	-	-	0.524	-	0.075	
Venus	-	-	-	-	-	-	0.402	0.057	
Echinocardium	-	-	-	-	-	-	2.392	0.342	
Grand Total	0.019	0.275	0.146	0.286	2.615	5.545	10.441	2.761	

Table X. Gairloch. Main traverse

A. Number of animals (per $^{1}/_{16}m^{2}$)

Species:	Stations I	II	III	IV	V	VI	VII	VIII	IX	X	XI
	MHWS	MHWN	-	-	MTL	MLWN	-	-	-	MLWS	-
Tellina tenuis	-	-	-	-	-	-	2	10	12	14	13
Spisula subtruncata	-	-	-	-	-	-	-	2	-	-	-
Venus striatula	-	-	-	-	-	-	1	-	-	1	-
Ensis ensis	-	-	-	-	-	-	-	-	-	1	-
Talitrus saltator	1	-	-	-	-	-	-	-	-	-	-
Pontocrates norvegicus	-	-	-	-	-	-	-	-	-	2	5
Megaluropus agilis	-	-	-	-	-	-	-	-	-	-	1
Bathyporeia pilosa	-	2	2	5	2	4	6	8	-	13	-
B. pelagica	-	-	-	-	1	-	44	41	9	5	-
B. elegans	-	-	-	-	1	-	-	36	19	19	22
B. guilliamsoniana	-	-	-	-	-	-	-	-	-	-	3
Eurydice pulchra	-	16	37	30	-	6	5	3	5	-	2
Pseudocuma gilsoni	-	-	-	-	-	-	-	1	16	1	3
Gastrosaccus spinifer	-	-	-	-	-	1	1	-	-	1	2
Nerine cirratulus	-	-	2	3	7	4	-	-	-	-	-
Spio filicornis	-	-	-	-	-	-	25	27	12	16	14
Ophelia rathkei	-	-	-	-	3	4	137	70	19	-	1
Travisia forbesi	-	-	-	-	-	-	-	2	1	3	1
Euzonus flabellifera	-	-	-	-	-	-	2	4	2	1	3
Sigalion mathildae	-	-	-	-	-	-	-	-	-	-	1
Nephtys cirrosa	-	-	-	-	-	-	-	-	-	-	1
Paraonis fulgens	-	-	-	-	-	1	2	-	2	3	4
Eteone longa	-	-	-	-	-	-	-	-	-	1	-
Capitellidae	-	-	-	-	-	-	-	2	-	-	-
Oligochaeta	1	4	3	1	-	-	5	-	-	-	-
Nemertea	-	-	-	2	2	-	9	2	1	-	-
Total	2	22	44	41	16	20	239	208	98	81	76

B. Biomass (g dry weight m^{-2})

Groups	Stations I	II	III	IV	V	VI	VII	VIII	IX	X	XI	Mean	%
Crustacea	0.017	0.147	0.349	0.214	0.005	0.131	0.201	0.262	0.113	0.115	0.126	0.153	6.8
Polychaeta	-	-	0.010	0.401	1.684	0.213	0.684	0.631	0.136	0.080	0.733	0.415	18.4
Mollusca	-	-	-	-	-	-	0.716	4.524	5.364	3.539	4.233	1.670	74.1
Others	0.004	0.006	0.004	0.008	0.004	-	0.163	0.003	0.002	-	-	0.019	0.7
Total	0.021	0.153	0.363	0.623	1.693	0.344	1.764	5.420	5.615	3.734	5.092	2.257	
Large specimens:													
Venus	-	-	-	-	-	-	0.201	-	-	-	-	0.018	
Spisula	-	-	-	-	-	-	-	0.979	-	-	-	0.089	
Grand Total	0.021	0.153	0.363	0.623	1.693	0.344	1.965	6.399	5.615	3.734	5.092	2.364	

Table XI. Big Sand. Main traverse

A. Numbers of animals (per $^{1}/_{16}m^{2}$)

Species	Stations I MHWS	II ~MHWN	III ~MTL	IV ~MLWN	V -	VI -	VII MLWS
Tellina tenuis	-	-	-	1	3	1	2
Venus striatula	-	-	-	-	-	1	1
Bathyporeia pelagica	-	-	-	6	9	11	1
B. elegans	-	-	-	-	-	3	18
Bathyporeia juv.	-	-	-	-	-	6	4
Pontocrates arenarius	-	-	-	-	-	-	1
Microprotopus maculatus	1	-	-	-	-	-	-
Eurydice pulchra	-	13	4	13	3	6	-
Pseudocuma longicornis	-	-	-	-	-	-	1
Paraonis fulgens	-	-	-	29	27	23	19
Spio filicornis	-	-	-	1	1	1	2
Nerine cirratulus	-	6	12	-	-	-	-
Ophelia rathkei	-	-	-	2	-	-	-
Euzonus flabelligera	-	-	-	-	-	-	2
Travisia forbesi	-	-	-	-	-	-	2
Psammodrilus balanoglossoides	-	-	-	3	14	90	26
Magelona papillicornis	-	-	-	-	-	1	-
Nephtys cirrosa	-	-	-	-	-	3	1
Syllidae	-	-	-	-	-	-	1
Oligochaeta	3	1	-	1	-	-	-
Nemertea	-	-	2	2	3	2	7
Total	4	20	18	58	60	148	88

B. Biomass (g dry weight m^{-2})

Groups	Stations I	II	III	IV	V	VI	VIII	Mean	%
Crustacea	0.002	0.104	0.035	0.054	0.064	0.095	0.124	0.068	5.5
Polychaeta	-	1.218	1.873	0.053	0.066	0.665	0.908	0.683	56.5
Mollusca	-	-	-	0.001	1.881	0.358	0.963	0.458	37.5
Others	0.005	0.010	0.007	0.020	0.010	0.010	0.005	0.010	0.5
Total	0.007	1.332	1.915	0.128	2.021	1.128	2.000	1.219	

Table XII. Turnberry. Main traverse

A. Numbers of animals (per $^{1}/_{16}m^{2}$)

Species	Stations I	II	III	IV	V	VI	VII	VIII	IX	X	XI
	MHWS	~MHWN	-	MTL	-	MLWN	-	-	-	-	MLWS
Tellina tenuis	-	-	1	3	-	9	3	4	10	16	22
Donax vittatus	-	-	-	-	-	-	-	1	1	4	3
Eurydice pulchra	-	-	6	-	-	-	-	4	-	-	2
Talitrus saltator (adults)	200	-	-	-	-	-	-	-	-	-	-
T.saltator (juvs)	1080	8	4	-	-	-	6	-	-	-	-
Bathyporeia pilosa	-	-	-	1	1	-	-	-	-	-	3
B. pelagica	-	-	2	-	1	-	1	4	5	10	10
B. elegans	-	-	-	-	-	5	-	-	-	-	7
Atylus swammerdami	-	-	-	-	-	1	-	-	-	-	1
Pontocrates norvegicus	-	-	-	-	-	3	1	1	2	2	-
Haustorius arenarius	-	-	14	-	-	-	-	1	6	-	-
Cumacea	-	-	-	-	-	-	1	-	-	-	-
Spio filicornis	-	-	-	-	-	-	3	2	-	3	-
Nerine cirratulus	-	2	6	-	5	2	-	1	-	-	-
Spiophanes bombyx	-	-	-	-	-	1	-	-	-	-	-
Paraonis fulgens	-	-	-	-	-	-	1	1	-	2	-
Arenicola marina	-	-	-	-	2	-	1	1	-	-	1
Eteone sp.	-	-	-	-	-	1	-	-	-	-	-
Nephtys cirrosa	-	-	-	-	-	2	2	1	1	3	3
Capitellidae	-	-	-	-	1	-	-	-	-	-	-
Insecta (larvae)	3	-	1	-	-	-	-	-	-	-	-
Oligochaeta	141	150	1	-	-	-	1	-	-	-	-
Nemertea	-	-	6	2	-	4	3	2	-	-	-
Total	1424	160	41	6	10	28	23	23	25	40	52

B. Biomass (g dry weight m^{-2})

Groups	Stations I	II	III	IV	V	VI	VII	VII	IX	X	XI	Mean	%
Crustacea	25.161	0.020	1.362	0.018	0.004	0.033	0.018	0.112	0.663	0.037	0.083	2.501	66.04
Polychaeta	-	0.778	0.271	-	0.529	1.717	1.592	0.645	0.028	0.573	-	0.557	14.70
Mollusca	-	-	0.004	0.140	-	0.537	0.515	0.578	1.934	1.724	1.747	0.653	17.21
Others	0.309	0.250	0.056	0.056	-	0.115	0.048	0.020	-	-	-	0.078	2.05
Total	25.470	1.048	1.693	0.214	0.535	2.402	2.173	1.355	2.625	2.334	11.830	3.789	-
Large individuals:													
Arenicola	-	-	-	-	-	-	-	5.765	-	-	22.402	2.561	
Donax	-	-	-	-	-	-	-	-	-	5.044	2.649	0.699	
Grand Total	25.470	1.048	1.693	0.214	0.533	2.402	2.173	7.120	2.625	7.378	26.881	7.049	

Table XIII. Lendalfoot. Main traverse

A. Numbers of animals (per $^{1}/_{16m^{2}}$)

Species	Stations I	II	III	IV	V	VI	VII
	MHWS	-	-	~MTL	MLWN	-	MLWS
Tellina tenuis	-	-	-	1	1	-	-
Haustorius arenarius	-	3	-	-	-	-	-
Talitrus saltator	-	1	-	-	-	-	-
Bathyporeia pilosa	2	-	-	1	-	1	1
B. pelagica	6	26	27	-	-	-	-
B. elegans	-	-	-	-	-	4	4
B. guilliamsoniana	-	-	-	-	-	2	-
Pontocrates norvegicus	-	1	1	2	2	1	3
P. arenarius	-	-	-	-	-	1	8
Gammarus sp. (juv.)	2	-	-	-	2	-	1
Dexamine spinosa	-	-	-	-	-	-	2
Atylus swammerdami	-	-	-	-	-	2	9
Eurydice pulchra	-	-	-	-	-	-	1
Idotea sp. (juv.)	-	-	-	-	1	-	4
Pseudocuma sp.	-	-	-	-	-	-	1
Bodotriidae	-	-	-	-	-	1	2
Diastylidae	-	-	-	-	-	-	1
Scoloplos armiger	-	-	-	-	1	-	-
Spio filicornis	-	-	5	-	2	-	-
Nerine cirratulus	-	14	1	1	-	-	-
Paraonis fulgens	-	-	1	1	-	-	-
Arenicola marina	-	6	2	1	1	1	-
Magelona papillicornis	-	-	-	-	1	1	9
Sigalion mathildae	-	-	-	-	-	1	-
Phyllodoce sp.	-	-	-	-	-	1	-
Glycera sp.	-	1	-	-	-	-	-
Nephtys cirrosa	-	-	2	3	6	3	-
N. hombergi	-	-	-	-	-	-	3
Capitellidae	-	2	-	-	-	-	2
Oligochaeta	685	11	2	-	2	1	1
Insecta	2 (larvae)	-	1 (adult)	-	-	-	-
Total	697	65	42	10	19	20	52

B. Biomass (g dry weight m^{-2})

Groups	Stations I	II	III	IV	V	VI	VII	Mean	%
Crustacea	0.006	0.361	0.033	0.010	0.012	0.041	0.145	0.087	4.6
Polychaeta	-	7.695	1.290	0.307	0.407	0.668	1.203	1.653	87.6
Mollusca	-	-	-	0.137	0.041	-	-	0.025	1.4
Others	0.819	0.020	0.007	-	0.007	0.002	0.002	0.122	6.4
Total	0.825	8.076	1.330	0.454	0.467	0.711	1.350	1.887	
Large individuals:									
Arenicola	-	10.163	4.556	1.117	8.394	2.677	-	3.844	
Grand total	0.825	18.239	5.886	1.571	8.861	3.388	1.350	5.731	

Table XIV. Port Logan. Main traverse .

A. Numbers of animals (per $^{1}/_{16}m^{2}$)

Species	Stations I MHWS	II -	III -	IV MHWN	V -	VI ~MTL	VII ~MLWN	VIII -	IX -	X ~MLWS
Tellina tenuis	-	-	-	-	-	1	2	-	1	-
Eurydice pulchra	1	26	11	3	2	1	2	2	-	1
Idotea sp. (juv.)	-	-	2	2	-	-	-	-	-	-
Bathyporeia pilosa	18	144	128	133	8	-	-	-	-	-
B. pelagica	4	-	2	28	73	20	8	8	6	1
B. elegans	-	-	3	-	-	-	1	4	1	-
Haustorius arenarius	-	15	27	18	11	-	-	1	-	-
Pontocrates norvegicus	1	1	1	2	2	-	1	3	2	-
P. arenarius	-	-	-	-	-	-	-	2	2	8
Atylus swammerdami	-	-	-	-	-	-	-	1	-	-
Scoloplos armiger	-	-	-	-	-	-	-	2	-	1
Spio filicornis	-	-	-	-	-	1	1	1	2	-
Pygospio elegans	-	-	-	-	-	-	1	-	-	2
Paraonis fulgens	-	-	-	-	-	2	4	13	14	19
Magelona papillicornis	-	-	-	-	-	-	-	2	1	2
M. filiformis	-	-	-	-	-	-	-	1	-	-
Capitellidae	-	-	-	-	-	-	-	1	-	4
Arenicola marina	-	-	-	-	1	1	-	-	-	-
Nephtys cirrosa	-	-	-	-	1	1	3	2	1	-
Oligochaeta	178	1	-	-	-	-	-	-	-	2
Anemone	-	-	-	-	-	-	-	1	-	-
Total	202	186	173	186	98	26	23	44	30	40

B. Biomass (g dry weight m^{-2})

Group	Stations I	II	III	IV	V	VI	VII	VIII	IX	X	Mean	%
Crustacea	0.049	0.919	1.148	0.871	0.763	0.079	0.039	0.049	0.024	0.016	0.396	36.0
Polychaeta	-	-	-	-	1.871	1.090	0.704	0.640	0.496	0.435	0.523	47.7
Mollusca	-	-	-	-	-	0.358	0.660	-	0.320	-	0.134	12.1
Others	0.422	0.002	-	-	-	-	-	0.030	-	0.005	0.046	4.2
Total	0.471	0.921	1.148	0.871	2.634	1.527	1.403	0.719	0.840	0.456	1.099	

Table XV. Traigh Mhor. Main traverse

A. Numbers of animals (per $^{1}/_{16}m^{-2}$)

Species	Stations																	
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI	XVII	XVIII
	~MHWN	-	-	MTL	-	-	MLWN	-	-	-	-	-	-	-	MLWS	-	-	-
Tellina tenuis	-	-	-	-		-	-	-	-	-	-	-	-	-	-	3	1	-
Cerastoderma edule	-	2	12	8	4	4	14	4	8	6	4	7	-	3	1	-	-	-
Dosinia exoleta	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	5	1
Venus striatula	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	-
Lucinoma borealis	-	-	-	-	-	-	-	-	-	2	-	1	-	3	-	-	-	-
Cochlodesma praetenue	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	2	-
Ensis sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Polyplacophora	-	-	-	-	-	-	-	-	1	-	1	8	1	-	-	-	-	-
Bathyporeia pilosa	2	-	-	1	-	1	-	-	-	-	1	-	-	-	-	-	-	-
B. guilliamsoniana	-	-	-	-	-	-	-	-	-	-	-	1	1	-	2	2	2	1
Megaluropus agilis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
Perioculodes longimanus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-
Pontocrates norvegicus	-	-	-	-	-	-	-	-	-	-	-	-	1	2	5	8	5	2
Amphilochidae	-	-	-	-	-	-	-	-	-	-	-	-	2	2	-	-	-	-
Tanais sp.	-	-	-	-	-	-	-	-	-	-	38	-	-	-	-	1	-	-
Eurydice pulchra	1	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Idotea sp. (juvs)	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Pseudocuma longicornis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Lamprops fasciata	-	-	-	-	-	-	-	-	-	-	-	-	6	3	3	1	2	-
Clymene oerstedi	-	-	-	-	-	-	-	-	2	1	11	-	-	4	5	-	2	2
Spio filicornis	-	1	40	25	14	27	6	4	22	5	5	11	4	1	-	2	4	2
Pygospio elegans	51	50	138	306	113	227	42	37	75	49	9	19	13	7	1	-	-	-
Scolelepis fuliginosa	16	11	7	1	3	2	9	8	-	-	-	-	-	-	-	-	-	-
Polydora sp.	-	-	-	-	-	-	-	-	1	-	1	-	-	-	-	-	-	-
Capitellidae	-	22	33	68	62	44	23	50	44	72	2	14	2	-	-	-	1	1
Notomastus sp.	-	-	-	-	-	-	-	-	-	-	1	-	1	3	1	-	1	2
Aricidea fauveli	-	3	36	4	18	7	23	2	12	7	8	17	5	5	1	7	11	5
Paraonis fulgens	-	-	9	-	2	8	1	-	3	-	-	-	-	-	-	-	-	-
Chaetozone setosa	-	-	140	25	15	54	106	103	162	107	1	11	9	3	2	1	-	4
Scoloplos armiger	-	-	2	1	2	-	-	-	5	7	2	11	19	16	1	-	-	4
Ophelia rathkei	6	5	23	1	3	-	8	9	13	3	-	1	-	-	1	-	-	-
Travisia forbesi	-	-	-	-	-	-	-	-	-	1	4	-	2	-	1	3	2	-
Arenicola marina	-	-	-	1	2	-	-	-	1	-	-	-	-	-	-	-	-	1
Fabricia sabella	90	1	9	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Psammodrilus balanoglossoides	-	-	1	1	1	-	-	-	1	-	-	-	-	-	-	-	-	-
Phyllodoce sp.	-	-	-	1	-	-	-	-	-	1	-	-	-	-	1	-	-	-
Nephtys hombergi	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	1	-	1
N.cirrosa	-	-	-	-	-	-	-	-	1	-	-	1	2	2	4	4	1	4
Nephtys sp.	-	-	-	-	-	-	-	-	-	-	2	-	-	-	1	-	-	-
Syllidae	-	-	-	8	-	9	2	-	22	29	190	16	141	66	24	63	204	11
Dorvillea sp.	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-
Sphaerodorum claparedii	-	-	-	-	-	-	-	-	1	-	-	-	1	-	-	-	-	-
Nereidae	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oligochaeta	468	35	29	2	12	14	46	55	22	13	13	4	15	-	-	1	-	-
Nemertea	4	-	-	-	-	2	1	-	-	4	1	-	-	-	-	-	1	-
Total	640	131	479	458	253	400	284	272	396	307	295	122	225	120	56	98	247	44

Table XV *(Continued)*

B. Biomass (g dry weight m^{-2})

	Stations																		
Groups	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI	XVII	XVIII	Mean	%
Crustacea	0.014	-	-	0.008	-	0.004	0.031	-	-	-	0.012	0.016	0.016	0.006	0.016	0.033	0.020	0.039	0.012	0.05
Polychaeta	0.409	0.258	1.896	5.178	2.803	0.865	0.588	0.473	8.225	6.469	0.939	0.550	5.342	8.721	1.592	2.007	0.307	2.506	2.729	13.80
Mollusca	-	-	-	-	-	-	-	-	0.002	0.015	0.022	0.017	0.008	0.056	0.613	1.515	2.346	1.909	0.361	1.80
Others	0.972	0.012	0.012	+	0.007	0.003	0.153	0.025	0.012	0.037	0.005	+	0.025	-	-	+	+	-	0.070	0.35
Total	1.395	0.270	1.908	5.186	2.810	0.872	0.772	0.498	8.239	6.521	0.978	0.583	5.391	8.783	2.221	3.555	2.673	4.454	3.172	
Large individuals:																				
Cerastoderma	-	0.289	24.196	21.907	19.594	3.782	54.685	18.071	19.218	16.084	25.902	44.584	-	21.293	29.728	-	-	-	16.629	84.00
Grand total	1.395	0.559	26.104	27.093	22.404	4.654	55.457	18.569	27.457	22.605	26.880	45.167	5.391	30.076	31.949	3.555	2.673	4.454	19.801	

Table XVI Gruinard. Main traverse

A. Numbers of animals (per $^{1}/_{16}m^{2}$)

Species	Stations																
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI	XVII
	~MHWN	-	-	MTL	-	MLWN	-	-	-	-	-	-	-	-	-	MLWS	-
Tellina tenuis	-	-	-	-	2	5	6	10	11	17	20	22	29	36	45	45	20
Cerastoderma edule	1	-	-	1	-	2	-	5	-	-	-	-	-	-	-	-	-
Venus striatula	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Talitrus saltator	3	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Gammarus sp. (juvs)	2	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Bathyporeia pilosa	1	28	67	15	30	151	1	13	1	6	-	-	-	2	3	-	-
B. pelagica	-	-	-	26	45	65	25	71	70	43	32	48	33	69	89	22	11
B. elegans	-	-	-	-	-	-	-	-	-	-	-	-	-	3	7	24	48
B. guilliamsoniana	-	-	-	-	-	-	-	-	-	-	-	-	1	1	3	3	5
Pontocrates norvegicus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	26
P. arenarius	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
Atylus swammerdami	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1	-	1
Eurydice pulchra	66	89	43	9	7	65	3	10	20	30	13	6	-	2	-	-	-
Pseudocuma longicornis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	7	26
Schistomysis spiritus	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Gastrosaccus spinifer	-	-	-	-	-	-	-	-	-	1	-	-	3	-	5	3	1
Euphausidacea	-	-	-	-	-	2	-	1	-	-	1	-	-	-	-	-	-
Siphonoecetes dellavallei	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Spio filicornis	-	-	-	-	-	12	44	99	3	16	11	16	47	27	23	14	9
Pygospio elegans	-	-	-	3	10	18	9	4	-	-	1	-	-	-	-	-	-
Nerine cirratulus	-	-	-	7	-	-	-	-	-	-	-	-	-	-	-	-	-
Paraonis fulgens	-	-	-	-	6	6	5	1	-	1	-	-	-	-	-	-	-
Ophelia rathkei	-	-	-	31	30	58	5	6	11	10	156	101	134	100	25	-	-
Travisia forbesi	-	-	-	-	-	-	-	2	-	2	4	6	3	2	1	-	-
Capitellidae	1	-	-	-	1	1	6	72	-	8	3	10	18	6	34	3	13
Psammodrilus balanoglossoides	-	-	-	-	-	2	8	3	-	-	3	-	3	-	1	-	-
Magelona papillicornis	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-
Arenicola sp.	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1
Sigalion mathildae	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	2	1
Phyllodoce sp.	-	-	-	-	-	-	-	2	-	-	-	-	-	1	-	-	-
Eteone sp.	-	-	-	1	-	3	5	1	-	-	1	-	-	-	-	1	-
Nephtys hombergi	-	-	-	-	-	1	2	1	1	-	-	-	1	-	2	-	-
N. cirrosa	-	-	-	-	-	-	-	1	-	-	-	1	1	1	1	4	6
Nephtys (juvs)	-	-	-	-	-	-	2	5	-	-	-	-	-	-	-	-	-
Oligochaeta	25	4	1	1	1	-	1	-	1	-	-	-	-	-	-	-	-
Nemertea	-	-	-	1	1	1	1	1	1	-	6	3	1	4	4	1	1
Total	99	121	111	98	135	392	123	310	119	134	251	213	275	254	248	130	174

Table XVI *(Continued)*

B. Biomass (g dry weight m^{-2})

Groups	Stations I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI	XVII	Mean	%
Crustacea	0.168	0.156	0.247	0.124	0.257	0.911	0.072	0.249	0.216	0.224	0.124	0.203	0.099	0.205	0.230	0.131	0.162	0.222	3.7
Polychaeta	0.002	-	-	0.762	0.148	0.299	0.371	2.240	0.396	1.873	1.653	4.423	2.324	0.883	1.497	2.933	3.632	1.378	23.3
Mollusca	0.005	-	-	0.006	0.660	2.901	1.870	1.584	3.348	5.913	5.712	5.488	8.601	10.628	10.931	11.121	4.110	4.286	72.5
Others	0.056	0.002	0.001	0.005	0.023	0.012	0.017	0.012	0.002		- 0.056	0.030	0.023	0.079	0.017	0.005	0.007	0.020	0.5
Total	0.231	0.158	0.248	0.897	1.088	4.123	2.330	4.085	3.962	8.010	7.545	10.144	11.047	11.795	12.675	14.190	7.911	5.906	

Table XVII Aultbea. Main traverse

A. Number of animals (per $^{1}/_{16m^{2}}$)

Species	Stations I	II	III	IV	V	VI	VII
	MLWN	-	-	-	-	~MLWS	-
Tellina tenuis	10	6	39	64	66	55	66
T. fabula	-	-	1	1	-	1	-
Venus striatula	-	-	-	1	-	2	-
Cochlodesma praetenue	-	-	1	5	8	7	5
Montacuta ferruginosa	-	-	-	1	-	3	6
Spisula subtruncata	-	-	1	1	1	1	-
Dosinia lupinus	-	-	-	-	1	-	-
Cerastoderma edule	3	-	2	1	-	-	-
Ensis sp.	-	-	-	-	-	-	2
Roxania sp.	-	-	-	1	-	1	1
Bathyporeia pilosa	-	1	-	-	-	-	-
B. guilliamsoniana	-	-	8	1	16	5	10
Ampelisca brevicornis	-	-	-	-	-	-	1
Scoloplos armiger	2	-	-	-	-	-	-
Spio filicornis	-	-	1	1	-	-	-
Spiophanes bombyx	1	-	-	-	-	-	2
Pygospio elegans	2	4	2	2	-	-	-
Spionidae	-	-	-	7	-	2	4
Scolelepis fuliginosa	2	-	-	1	-	-	-
Ophelia rathkei	13	11	30	9	17	1	-
Travisia forbesi	-	2	10	10	16	22	12
Capitellidae	9	1	3	1	-	2	-
Psammodrilus balanoglossoides	-	1	1	6	13	11	4
Chaetozone setosa	-	-	1	-	-	-	-
Magelona alleni	1	-	-	-	-	-	-
M. papillicornis	1	2	2	-	1	-	-
M. filiformis	1	2	1	8	3	-	-
Arenicola marina	1	-	-	-	-	-	-
Owenia fusiformis	-	-	-	-	-	2	-
Lanice conchilega	-	1	-	-	-	-	-
Terebellidae (juv.)	-	1	-	-	-	-	-
Phyllodoce sp.	-	-	2	-	-	-	-
Eteone longa	-	-	2	-	1	-	-
Nephtys hombergi	1	1	-	-	-	-	-
N. cirrosa	-	-	-	3	5	3	9
Glycera sp.	1	-	-	-	-	-	1
Glycinde nordmanni	-	-	-	-	-	-	1
Exogone hebes	93	41	105	22	4	4	-
Syllidae	-	8	4	3	5	8	-
Nerine cirratulus	-	-	-	-	-	1	-
Oligochaeta	47	13	3	2	-	-	-
Nemertea	3	-	2	3	2	4	1
Echinocardium cordatum	-	-	-	1	-	-	2
Anemone	-	-	-	1	-	-	-
Total	191	95	221	156	159	135	127

Table XVII *(Continued)*

B. Biomass (g dry weight m^{-2})

Groups:	Stations I	II	III	IV	V	VI	VIII	Mean	%
Crustacea	0.008	0.001	0.037	0.024	0.099	0.031	0.064	0.038	0.5
Polychaeta	1.001	2.790	4.236	1.561	2.283	1.738	2.293	2.272	31.2
Mollusca	0.153	0.470	2.811	5.728	7.785	8.467	9.187	4.943	67.9
Others	0.043	0.002	0.017	0.010	0.064	0.104	0.002	0.034	0.4
Total	1.205	3.263	7.101	7.323	10.231	10.340	11.546	7.287	
Large Individuals:									
Arenicola	2.472	-	-	-	-	-	-	0.353	
Echinocardium	-	-	-	1.969	-	-	4.329	0.899	
Cerastoderma	-	-	85.008	-	-	-	-	12.144	
Cochlodesma	-	-	0.672	-	3.068	1.545	-	0.755	
Grand Total	3.677	3.263	92.781	9.292	13.299	11.885	15.875	21.438	

Table XVIII Inverasdale. Main traverse

A Number of animals (per $^1/_{16}m^2$)

Species	Stations II ~MLWN	III -	VIII ~MLWS	IX -
Mytilus edulis (juv.)	-	-	7	-
Spisula subtruncata	-	5	15	9
Tellina fabula	-	3	1	2
T. tenuis	15	12	-	-
Dosinia exoleta	1	-	-	-
Montacuta ferruginosa	-	2	-	-
Ensis sp. (juv.)	-	-	1	1
Ampelisca brevicornis	-	-	-	1
Bathyporeia elegans	12	37	13	5
B. pelagica	11	14	-	2
B. pilosa	1	19	1	2
Perioculodes longimannus	-	-	8	25
Calliopius laeviusculus	-	1	-	-
Eurydice pulchra	-	1	-	-
Gnathia maxillaris (larva)	-	1	-	-
Iphinoe trispinosa	-	-	-	1
Pseudocuma sp.	-	-	-	1
Eteone longa	1	-	1	-
Glycera sp.	-	-	-	1
Nephtys cirrosa	4	5	3	8
Phyllodocidae	-	-	-	2
Spio filicornis	-	-	3	9
Pygospio elegans	1	-	-	-
Magelona papillicornis	-	3	12	51
Chaetozone setosa	-	-	-	2
Capitellidae (juv.)	-	-	-	7
Capitella capitata	-	-	-	1
Travisia forbesi	1	-	-	
Owenia fusiformis	-	1	-	1
Arenicola marina	-	-	-	1
Paraonidae	-	-	2	1
Opheliidae	-	-	1	
Nemertea	2	-	-	4
Echinocardium cordatum	-	1	-	
Total	49	105	68	137

B. Biomass (g dry weight m^{-2})

Groups:	Stations II	V	VIII	IX	Mean	%
Crustacea	0.074	0.164	0.037	0.073	0.087	3.8
Polychaeta	0.933	0.921	0.506	1.648	1.002	43.6
Mollusca	1.975	2.055	0.291	0.413	1.183	51.5
Others	0.002	-	-	0.097	0.025	1.1
Total	2.984	3.140	0.834	2.231	2.297	
Large individuals:						
Arenicola	-	-	-	60.102	15.026	
Dosinia	0.810	-	-	-	0.202	
Echinocardium	-	2.150	-	-	0.538	
Grand Total	3.794	5.290	0.834	62.333	18.063	

Table XIV. Loch Gilp. Main traverse

A. Numbers of animals (per $^1/_{16}m^2$)

Species	Stations I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII
	~MTL	-	-	~MLWN	-	-	-	MLWS	-	-	-	-	-
Tellina tenuis	-	-	-	12	29	45	40	35	40	88	121	148	62
T. fabula	-	-	-	-	-	-	-	-	-	-	-	-	17
Macoma balthica	3	4	3	3	-	-	-	-	-	-	-	-	-
Cerastoderma edule	-	-	-	1	2	1	2	1	9	13	1	-	-
Parvicardium minimum	-	-	1	-	-	-	-	-	-	-	-	-	-
Ensis sp.	-	-	-	-	-	-	1	-	-	-	-	-	-
Mya arenaria	-	1	2	-	-	-	-	-	-	-	-	-	-
Thracia sp.	-	-	1	-	-	-	-	-	-	-	-	-	-
Spisula subtruncata	-	-	-	-	-	-	-	-	-	-	1	-	4
Hydrobia ulvae	121	95	303	29	3	1	1	-	-	-	-	-	-
Corophium volutator	343	9	4	-	-	-	-	-	-	-	-	-	-
Bathyporeia guilliamsoniana	-	-	-	-	1	1	-	1	-	3	6	35	3
Ampelisca brevicornis	-	-	-	-	-	-	-	-	-	-	-	2	-
Lamprops fasciata	-	-	-	-	-	-	-	-	1	1	4	4	1
Pseudocuma longicornis	-	-	-	-	-	-	-	-	-	-	-	-	1
Diastylidae	-	-	-	-	-	-	-	-	-	-	-	1	1
Magelona papillicornis	-	-	-	-	-	-	-	-	-	-	-	-	1
Spio filicornis	-	-	-	-	3	8	9	2	3	3	2	9	3
Pygospio elegans	158	56	23	25	1	5	4	-	-	-	3	6	-
Scolelepis fuliginosa	1	-	-	-	-	-	-	-	-	-	-	-	-
Spiophanes bombyx	-	-	-	-	-	-	-	-	-	-	-	1	-
Capitellidae	-	38	19	11	7	10	2	-	1	2	1	1	7
Aricidea fauveli	-	-	-	-	2	12	26	4	-	-	4	1	-
Chaetozone setosa	-	-	-	-	-	-	6	-	2	-	-	1	-
Scoloplos armiger	-	-	1	11	4	16	10	5	10	8	2	1	5
Arenicola marina	-	-	2	-	-	-	-	1	-	1	1	-	-
Fabricia sabella	155	795	53	81	-	-	-	-	-	-	-	-	-
Psammodrilus balanoglossoides	-	-	-	-	1	1	1	-	1	-	-	-	-
Nereis diversicolor	42	-	-	-	-	-	-	-	-	-	-	-	-
Phyllodoce sp.	-	-	-	-	2	3	1	-	-	3	1	-	8
Eteone sp.	2	3	-	6	1	2	1	-	-	-	-	-	1
Nephtys hombergi	-	-	-	-	3	1	3	2	2	4	3	9	6
Syllidae	-	-	-	-	-	-	-	-	-	7	12	10	-
Dorvillea sp.	-	-	-	-	-	1	-	-	-	-	-	-	-
Echinocardium cordatum	-	-	-	-	-	-	-	-	-	-	-	1	-
Nemertea	2	2	2	-	-	-	-	1	-	-	-	-	-
Oligochaeta	401	515	57	55	2	6	2	1	-	-	2	-	1
Insecta (larvae)	3	-	-	-	-	-	-	-	-	-	-	-	-
Total	1231	1518	471	234	61	113	109	53	69	133	164	230	121

B. Biomass (g dry weight m^{-2})

Groups	Stations I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	Mean	%	
Crustacea	1.468	0.091	0.027	0.230	0.012	0.056	0.087	0.010	0.544	0.027	0.099	0.665	0.035	0.258	0.60	
Polychaeta	2.128	0.652	2.437	0.995	0.734	1.149	0.829	2.076	0.898	3.064	4.195	1.607	1.479	1.711	4.02	
Mollusca	3.288	3.876	6.841	1.833	3.700	5.070	4.565	3.940	3.905	10.077	12.299	10.952	3.384	5.671	-	
Others	0.396	1.681	0.148	0.143	0.002	0.002	0.002	0.145	-	-	+	+	-	0.194	0.45	
Total	7.280	6.300	9.453	3.201	4.448	6.277	5.483	6.171	5.347	13.168	16.593	13.224	4.898	7.834	-	
Large individuals:																
Cerastoderma	-	-	-	3.608	4.229	9.390	19.279	9.656	91.532	288.092	11.498	-	-	33.637	40.319	or 94.70
Spisula	-	-	-	-	-	-	-	-	-	-	3.107	-	10.043	1.011	-	
Echinocardium	-	-	-	-	-	-	-	-	-	-	-	0.801	-	0.062	0.03	
Grand total	7.280	6.300	9.453	6.809	8.677	15.667	24.762	15.827	96.879	301.260	31.198	14.025	14.941	42.544		

Table XX. Barassie. Main traverse

A. Numbers of animals (per $^{1}/_{16}m^{2}$)

Species	Stations I	II	III	IV	V	VI	VII	VIII	IX	X
	MHWS	-	MHWN	-	-	MTL	-	MLWN	-	~MLWS
Tellina tenuis	-	2	-	2	23	26	44	109	166	218
Donax vittatus	-	-	-	-	-	-	2	1	3	17
Spisula elliptica	-	-	-	-	-	-	-	-	-	1
Venus striatula	-	-	-	-	2	-	-	-	-	1
Eurydice pulchra	-	-	-	1	2	-	-	-	-	-
Urothoe elegans	-	-	-	-	1	-	5	2	-	1
Bathyporeia pilosa	28	5	8	11	67	237	31	2	7	35
B. pelagica	-	-	1	-	-	2	38	8	-	-
B. elegans	-	-	-	3	-	1	-	4	39	73
Pontocrates norvegicus	-	-	-	-	-	-	1	5	10	34
P. arenarius (juvs)	-	-	-	-	-	-	-	-	1	2
Gammarus sp.	-	-	1	-	-	-	-	-	-	-
Atylus swammerdami	-	-	-	-	-	-	-	-	-	4
Corophium volutator	11	1	1	-	-	-	-	-	-	-
Iphinöe trispinosa	-	-	-	-	-	-	-	-	-	1
Bodotria scorpioides	-	-	-	2	-	4	7	21	13	4
Pseudocuma longicornis	-	-	-	1	-	3	-	4	3	48
Spio filicornis	-	-	-	1	1	15	28	23	39	42
Pygospio elegans	4	5	-	-	-	-	-	-	-	-
Nerine cirratulus	-	3	11	4	1	-	-	-	-	-
Spiophanes bombyx	-	-	-	-	-	-	-	-	-	1
Psammodrilus balanoglossoides	-	2	-	-	-	1	-	-	-	-
Chaetozone setosa	-	-	-	-	-	-	-	2	4	3
Capitellidae	4	29	10	22	56	20	13	23	51	9
Magelona papillicornis	-	-	-	-	-	-	1	-	-	-
Arenicola marina	-	2	-	2	1	2	1	1	1	-
Sigalion mathildae	-	-	-	-	-	-	-	-	-	1
Phyllodoce sp.	-	-	-	-	-	-	-	-	3	4
Eteone sp.	-	2	2	1	3	1	-	-	-	-
Nereis sp.	-	12	-	-	-	-	-	-	-	-
Nephtys cirrosa	-	-	-	-	-	1	-	2	3	3
N. hombergi	-	-	-	1	-	-	1	1	2	2
Insecta (larvae)	5	-	-	-	-	-	-	-	-	-
Oligochaeta	6	-	1	-	-	-	1	-	-	-
Nemertea	-	5	2	-	8	4	-	-	-	-
Total	58	68	37	51	165	317	173	208	345	504

B. Biomass (g dry weight m^{-2})

Groups	Stations I	II	III	IV	V	VI	VII	VIII	IX	X	Mean	%
Crustacea	0.124	0.020	0.033	0.024	0.180	0.809	0.266	0.043	0.104	0.351	0.195	
Polychaeta	0.030	3.097	1.346	1.950	2.414	2.521	1.136	2.291	4.497	3.773	2.306	10.3
Mollusca	-	0.156	-	0.236	4.669	6.034	10.028	23.651	40.642	59.017	14.443	80.5
Others	0.017	0.097	0.038	-	0.102	0.056	0.002	-	-	-	0.031	
Total	0.171	3.370	1.417	2.210	7.365	9.420	11.432	25.985	45.243	63.141	16.975	
Large individuals:												
Arenicola	-	-	-	-	-	15.825	8.181	-	-	-	2.401	
Spisula	-	-	-	-	-	-	-	-	-	6.641	0.664	
Grand Total	0.171	3.370	1.417	2.210	7.365	25.245	19.613	25.985	45.243	69.782	20.040	

Table XXI. Prestwick. Main traverse

A. Numbers of animals (per $^{1}/_{16}m^{2}$)

Species	Stations I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV
	MHWS	~MHWN	-	-	MTL	-	-	-	-	-	MLWN	-	-	-	~MLWS
Tellina tenuis	-	-	1	-	3	23	45	55	55	58	60	94	104	96	94
Donax vittatus	-	-	2	-	2	5	2	7	-	-	8	3	5	3	8
Venus striatula	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
Urothöe elegans	-	-	-	-	-	1	1	3	4	1	2	4	-	1	-
Bathyporeia pilosa	-	-	3	-	1	1	1	-	4	-	-	-	-	-	8
B. pelagica	-	-	-	-	1	1	1	1	5	21	14	2	-	-	-
B. elegans	-	-	-	-	-	-	-	-		-	1	2	7	13	48
Gammarus sp. (juvs.)	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-
Pontocrates norvegicus	-	-	-	-	13	4	12	4	17	16	3	6	6	1	2
Eurydice pulchra	-	5	35	8	-	1	1	2	4	-	1	-	-	-	-
Pseudocuma longicornis	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
Bodotria scorpioides	-	-	-	-	3	-	1	-	18	12	6	15	-	5	-
Spio filicornis	-	-	-	-	2	8	9	2	-	11	20	25	19	31	42
Nerine cirratulus	-	7	12	11	6	3	2	2	-	-	-	-	-	-	-
Spiophanes bombyx	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
Spionidae	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-
Paraonis fulgens	-	-	-	-	6	1	-	-	-	-	-	-	-	-	-
Chaetozone setosa	-	-	-	-	-	-	-	-	-	-	-	3	1	-	1
Magelona papillicornis	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
Ophelia rathkei	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
Arenicola marina	-	-	3	1	1	4	2	3	-	-	1	-	2	-	-
Phyllodoce sp.	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-
Eteone sp.	-	2	1	1	1	1	2	1	1	-	1	-	3	-	-
Sigalion mathildae	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-
Nephtys cirrosa	-	-	-	-	-	-	-	-	-	1	-	1	-	1	-
N.hombergi	-	-	-	-	-	-	1	-	1	1	-	-	1	-	1
Capitellidae	-	4	8	3	5	9	26	4	27	35	10	16	33	2	2
Nemertea	-	-	-	-	1	7	1	-	2	12	-	-	3	-	1
Oligochaeta	8	-	2	1	-	-	-	-	-	-	-	-	-	-	-
Total	8	18	67	25	45	70	107	85	141	169	128	174	185	154	207

B. Biomass (g dry weight m^{-2})

Groups	Stations I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	Mean	%
Crustacea	-	0.035	0.341	0.079	0.037	0.064	0.069	0.054	0.081	0.062	0.085	0.106	0.043	0.072	0.149	0.085	0.7
Polychaeta	-	4.134	5.061	1.976	3.496	3.729	1.085	0.476	0.097	1.100	2.250	2.739	2.933	1.039	1.809	2.128	19.1
Mollusca	-	-	0.759	-	3.355	5.247	7.842	11.053	11.217	12.397	12.580	17.577	17.662	17.027	16.844	8.904	79.9
Others	0.023	-	0.007	0.002	0.015	0.112	0.023	-	0.020	0.030	-	-	0.023	-	0.010	0.018	
Total	0.023	4.169	6.168	2.057	6.903	9.152	9.019	11.583	11.415	13.589	14.915	20.422	20.661	18.138	18.812	11.135	
Arenicola	-	-	-	-	-	-	10.775	8.710	-	-	-	-	43.102	-	-	4.173	
Nephtys	-	-	-	-	-	-	-	-	3.000	-	-	-	-	-	-	0.200	
Grand Total	0.023	4.169	6.168	2.057	6.903	9.152	19.794	20.293	14.415	13.589	14.915	20.422	63.763	18.138	18.812	15.508	

Table XXII. Sandhead. Main traverse

A. Numbers of animals (per $^{1}/_{16}m^{2}$)

Species	Stations I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV
	~MHWN	-	-	-	MTL	-	-	-	-	MLWN	-	-	-	~MLWS	-
Tellina tenuis	2	9	10	10	-	1	44	80	73	73	55	2	1	-	-
Donax vittatus	-	-	-	-	-	-	-	-	2	1	-	1	-	-	-
Cerastoderma edule	-	-	1	-	-	-	1	1	1	1	-	-	-	-	-
Eurydice pulchra	27	1	2	3	-	-	-	-	-	-	1	1	-	-	-
Haustorius arenarius	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-
Bathyporeia pilosa	22	18	37	31	32	6	9	2	-	-	1	-	3	1	11
B. pelagica	-	-	-	-	-	-	-	-	-	-	1	-	1	-	-
B. elegans	-	-	-	-	-	-	-	-	-	-	-	-	-	20	24
Pontocrates norvegicus	-	-	-	-	-	-	-	-	-	1	-	1	-	4	6
P. arenarius	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-
Aricidea sp.	-	-	-	-	-	-	-	-	1	1	-	-	-	-	1
Spio filicornis	-	-	-	-	-	-	1	-	2	-	-	-	-	-	-
Nerine cirratulus	3	1	-	-	1	-	-	1	-	-	-	-	-	-	-
Spiophanes bombyx	-	-	-	-	-	-	1	-	1	1	1	-	1	2	1
Pygospio elegans	35	28	19	23	3	2	2	-	-	-	-	-	-	-	-
Psammodrilus balanoglossoides	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Capitellidae	-	-	-	-	-	-	-	7	-	-	-	-	1	-	-
Chaetozone setosa	-	-	-	-	-	-	-	-	-	-	-	-	1	2	-
Magelona papillicornis	-	-	-	-	-	-	-	-	-	-	1	3	7	4	6
Owenia fusiformis	-	-	-	-	-	-	-	-	-	-	2	-	7	2	3
Sigalion mathildae	-	-	-	-	-	-	-	-	-	1	2	2	1	1	1
Ophelia rathkei	24	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Nereis sp. (juvs)	-	-	1	-	6	5	-	-	-	-	-	-	-	-	-
Phyllodoce sp.	-	-	-	-	-	-	-	-	1	-	-	1	-	-	-
Eteone sp.	4	5	1	5	-	-	-	1	-	-	-	-	1	1	-
Nephtys cirrosa	-	1	4	-	2	2	4	14	2	4	3	4	1	-	2
N. hombergi	1	-	1	1	-	-	2	-	1	1	1	-	1	-	1
Nephtys sp.	-	-	-	-	-	-	3	2	5	6	4	1	1	2	2
Nephtys (juvs)	-	-	-	-	-	-	5	-	2	-	-	1	-	-	1
Oligochaeta	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
Nemertea	2	5	1	12	3	-	-	-	-	-	-	2	-	-	-
Echinocardium cordatum	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
Insecta (larvae)	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Total	120	70	78	85	48	17	73	107	91	90	72	19	27	42	59

B. Biomass (g dry weight m^{-2})

Groups	Stations I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	Mean	%
Crustacea	0.153	0.068	0.236	0.230	0.220	0.301	0.027	0.108	0.126	0.180	0.064	0.158	0.020	0.056	0.131	0.139	3.1
Polychaeta	1.694	0.606	0.872	0.281	0.330	0.686	2.979	1.794	1.817	3.118	3.217	0.714	1.361	0.535	1.479	1.432	32.8
Mollusca	0.324	1.993	2.269	2.060	-	0.011	7.067	8.500	7.841	6.998	4.457	0.007	0.002	0.201	0.100	2.788	63.9
Others	0.007	0.012	0.002	0.107	0.007	-	0.002	-	-	-	-	0.015	-	-	-	0.010	0.2
Total	2.178	2.679	3.379	2.678	0.557	0.998	10.075	10.402	9.784	10.296	7.738	0.894	1.383	0.792	1.710	4.369	
Large individuals																	
Cerastoderma	-	-	-	-	-	-	1.145	0.435	7.436	16.556	-	-	-	-	-	1.705	
Echinocardium	-	-	-	-	-	-	-	-	-	-	-	-	-	0.809	-	0.054	
Grand Total	2.178	2.679	3.379	2.678	0.557	0.998	11.220	10.837	17.220	26.852	7.738	0.894	1.383	1.601	1.710	6.128	

Table XXIII Fauna list and distribution

(Numbers 1-21 refer to the beaches shown on p.2)

Polychaeta

Sigalion mathildae Audouin & M. Edwards: 7, 13, 16, 17, 19, 21

Phyllodoce maculata (L.) : 12

Phyllodoce sp.: 4, 6, 7, 8, 9, 15, 16, 17, 19, 21

Phyllodocidae : 10

Eteone longa (Fabricius): 5, 9, 10, 13

Eteone sp. : 1, 4, 7, 8, 15, 16, 17, 18, 21

Syllis sp. : 12

Syllidae : 5, 6, 9, 14, 15

Exogone hebes (Webster & Benedict) : 9

Nereis diversicolor O. F. Müller : 15

Nereis sp. : 16, 21

Nereidae : 6

Nephtys hombergi Savigny : 5, 6, 7, 9, 15, 16, 17, 19, 21

Nephtys cirrosa Ehlers : 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 16, 17, 18, 19, 20, 21

Nephtys sp. : 6, 7, 21

Sphaerodorum claparedii Greef : 6

Glycera sp. : 9, 10, 19

Glycinde nordmanni (Malmgren) : 9

Dorvillea sp. : 6, 15

Orbinia sp. : 12

Scoloplos armiger (O. F. Müller) : 6, 9, 15, 19, 20

Scolelepis fuliginosa (Claparède) : 6, 9, 11, 15

Nerine cirratulus (delle Chiaje) : 1, 2, 3, 4, 5, 7, 8, 9, 11, 12, 13, 14, 16, 17, 18, 19, 21

Spiophanes bombyx (Claparède) : 9, 15, 16, 17, 18, 21

Spio filicornis (O. F. Müller) : 4, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21

Pygospio elegans Claparède : 5, 6, 7, 9, 10, 15, 16, 20, 21

Polydora sp. : 6

Spionidae : 8, 9, 17

Magelona alleni Wilson : 9

Magelona papillicornis O.F. Müller : 7, 8, 9, 10, 14, 15, 16, 17, 19, 20, 21

Magelona filiformis Wilson : 9, 20

Poecilochaetus serpens Allen : 12

Psammodrilus balanoglossoides Swedmark : 6, 7, 9, 11, 12, 14, 15, 16, 21

Paraonis fulgens (Levinson) : 1, 2, 3, 4, 6, 7, 8, 11, 12, 13, 14, 17, 18, 19, 20

Paraonidae : 10

Aricidea fauveli Hartman : 6, 15

Aricidea sp. : 5, 21

Chaetozone setosa Malmgren : 6, 8, 9, 10, 15, 16, 17, 21

Ophelia rathkei (McIntosh) : 2, 3, 4, 6, 7, 9, 11, 12, 13, 14, 17, 21

Travisia forbesi Johnston : 6, 7, 9, 10, 13, 14

Euzonus flabellifera (Ziegelmeier) : 13, 14

Opheliidae : 10

Notomastus sp. : 6

Capitella capitata (Fabricius) : 10

Capitellidae : 1, 2, 5, 6, 7, 8, 9, 10, 11, 13, 15, 16, 17, 18, 19, 20, 21
Arenicola marina L. : 6, 8, 9, 10, 15, 16, 17, 18, 19, 20
Arenicola sp. : 7
Clymene oerstedi Claparède : 6
Owenia fusiformis delle Chiaje : 9, 10, 21
Lanice conchilega (Pallas) : 9
Terebellidae : 9
Fabricia sabella (Ehrenberg) : 6, 15

Archiannelida : 2

Oligochaeta : 2, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21

Crustacea
Ampelisca brevicornis (Costa) : 9, 10, 15
Bathyporeia guilliamsoniana (Bate) : 2, 6, 7, 9, 13, 15, 19
Bathyporeia pelagica (Bate) : 4, 5, 7, 8, 10, 11, 12, 13, 14, 16, 17, 18, 19, 20, 21
Bathyporeia elegans Watkin : 7, 8, 10, 11, 12, 13, 14, 16, 17, 18, 19, 20, 21
Bathyporeia pilosa Lindström : 1, 2, 3, 6, 7, 8, 9, 10, 11, 12, 13, 16, 17, 18, 19, 20, 2
Bathyporeia juv. : 14
Haustorius arenarius (Slabber) : 1, 18, 19, 20, 21
Urothoë elegans Bate : 16, 17
Amphilochidae : 6
Stenothoë marina (Bate) : 12
Cressa dubia (Bate) : 12
Perioculodes longimanus (Bate & Westwood) : 6, 10
Pontocrates arenarius (Bate) : 7, 12, 14, 16, 19, 20, 21
Pontocrates norvegicus Boeck : 1, 2, 3, 4, 5, 6, 7, 13, 16, 17, 18, 19, 20, 21
Synchelidium haplocheles (Grube) : 12
Calliopius laeviusculus (Krøyer) : 2, 10
Atylus swammerdami (M. Edwards) : 7, 8, 12, 16, 18, 19, 20
Megaluropus agilis Hoek : 6, 13
Melita obtusata (Montagu) : 12
Gammarus locusta (L.) : 12
Gammarus sp. : 7, 16, 17, 19
Dexamine spinosa (Montagu) : 19
Talitrus saltator (Montagu) : 1, 2, 5, 7, 11, 13, 18, 19
Microprotopus maculatus Norman : 14
Siphonoecetes dellavallei Stebbing : 7, 12
Corophium volutator Pallas : 15, 16

Gnathia maxillaris (Montagu) : 10
Eurydice pulchra Leach : 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 16, 17, 18, 19, 20, 21
Idotea sp. : 2, 6, 12, 19, 20
Cumacea : 18
Bodotria scorpioides (Montagu) : 16, 17
Iphinoë trispinosa (Goodsir) : 10, 16
Bodotriidae : 19

Lamprops fasciata G.O. Sars : 5, 6, 15

Pseudocuma longicornis (Bate) : 5, 6, 7, 8, 12, 14, 15, 16, 17

Pseudocuma gilsoni Bacescu : 13

Pseudocuma sp. : 10, 19

Diastylidae : 15, 19

Schistomysis spiritus Norman : 7

Gastrosaccus spinifer (Goës) : 7, 13

Tanais sp. : 6

Euphausidacea : 7

Mollusca

Lacuna vincta (Montagu) : 11

Hydrobia ulvae (Pennant) : 15

Roxania sp. : 9

Mytilus edulis L. : 8, 10

Lucinoma borealis (L.) : 6

Montacuta ferruginosa (Montagu) : 9, 10

Parvicardium minimum Philippi : 15

Cerastoderma edule L. : 6, 7, 9, 15, 21

Dosinia exoleta (L.) : 6, 10

Dosinia lupinus (L.) : 9

Venus striatula da Costa : 6, 7, 8, 9, 12, 13, 14, 16, 17

Spisula subtruncata (da Costa) : 9, 10, 13, 15

Spisula elliptica (Brown) : 16

Macoma balthica (L.) : 15

Tellina fabula Gmelin : 9, 10, 15

Tellina tenuis da Costa : 3, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21

Donax vittatus (da Costa) : 16, 17, 18, 21

Ensis ensis (L.) : 13

Ensis sp. : 6, 9, 10, 15

Mya arenaria L. : 15

Thracia sp. : 15

Cochlodesma praetenue (Montagu) : 6, 9

Polyplacophora : 6

Echinodermata

Echinocardium cordatum (Pennant) : 9, 10, 12, 15, 21

Miscellaneous

Nemertea : 1, 2, 4, 6, 7, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 21

Ammodytes lanceolatus Lesauvage : 3

Insect larvae : 1, 8, 11, 15, 16, 18, 19, 21

Anemones : 9, 20

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